VOL. XXIX. NEW YORK—THURSDAY, SEPTEMBER 4, 1913—CHICAGO No. 10

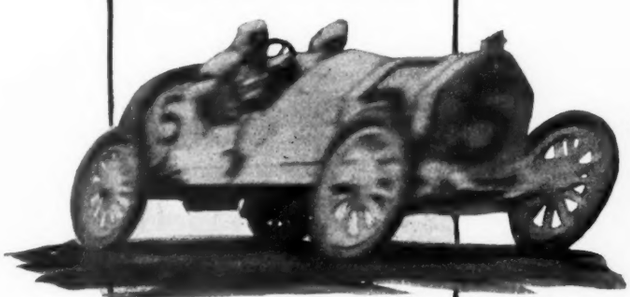
The AUTOMOBILE

Stutz Wins Elgin Classic

Anderson Pilots Victor at 71.4 m. p. h.—Mulford in a Small Mason Second—De Palma in a Mercer Wins Chicago Automobile Trophy in Second Day's Race

THEIR FASTEST LAP
Elgin National Trophy

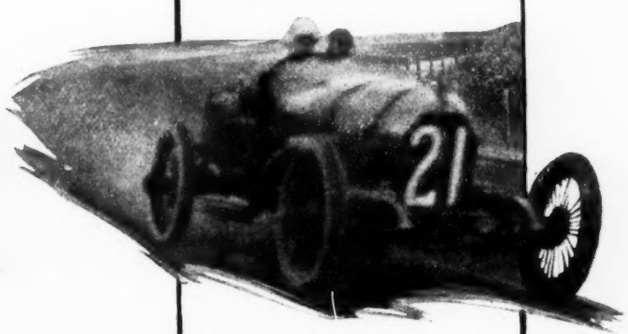
No. and Car	Lap	Time	M.P.H.
4—Mercer	2	6:38	75.85
5—Stutz	16	6:43	74.9
1—Case	6	6:49	73.8
6—Marmon	7	6:52	73.3
16—Erwin	23	6:58	72.3
7—Mason	15	7:00	71.9
3—Mason	14	7:01	71.7
14—Mercer	12	7:14	69.5
15—Isotta	21	7:15	69.3
8—Keeton	7-8	7:15	69.3
12—Velie	1	8:33	50.0



Anderson and the winning Stutz

THEIR FASTEST LAP
C. A. C. Trophy

No. and Car	Lap	Time	M.P.H.
22—Mason	2	7:00	71.9
26—Mason	7	7:01	71.7
20—Deltal	7	7:04	71.2
21—Mercer	5	7:07	70.7
23—Mercer	7	7:16	69.2
24—Mason	3	7:24	68.0
25—Endicott	25	7:46	64.8
27—Mason	14	7:59	62.9



De Palma and the victorious Mercer

ELGIN, ILL., Aug. 30.—Gil. Anderson in a Stutz and Ralph De Palma in a Mercer carried off premier honors in the 2-day racing program on the Elgin road circuit which reached a successful culmination this evening. In today's race, 301.84 miles for the Elgin National trophy, Anderson piloted the Stutz to victory establishing a new record of 71.4 miles per hour, as compared with 68.9 miles per hour last year and with a 450-cubic inch limitation as compared with a 600-inch limitation a year ago.

In yesterday's race for the Chicago Automobile Club trophy over the same course and for the same distance De Palma pushed the yellow Mercer to victory over Dawson in a Deltol, which held second honors. The Mercer's average was 66.8 miles per hour, a fast pace for 300-cubic inch cars.

Speed honors for the fastest laps were captured by Rickenbacher in a Mason in the C. A. C. Friday race and by Spencer Wishart in a Mercer in the Elgin National today. Wishart set a new record for the course covering the 8 miles 2030 feet in 6:38, an average of 75.84 miles per hour. In Friday's race the Mason special set a new mark of 7:00 flat, a speed of 71.9 miles per hour.

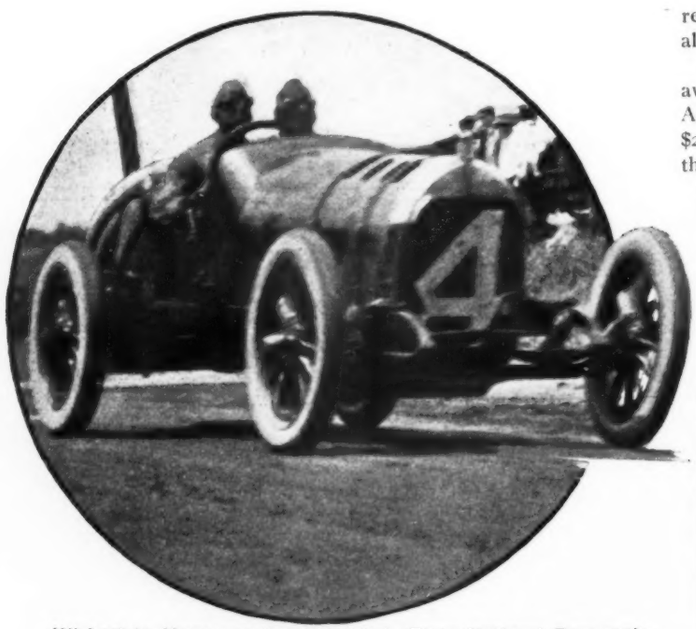
Perfect weather, fast course, large crowds and excellent military guarding of the course were features of both days' racing, which proved the best ever held on the now historic Elgin course, the present meet being the fourth annual one. The crowds on the opening day were moderate, but today the attendance was estimated at close to 50,000.

Not a single accident marred the 2-days' racing and the week of practice. Rarely have cars stood up so well through the race. In fact today's race established a new record in this respect.

In the race for the Elgin national trophy twelve starters were

TABLE SHOWING LAP TIMES IN THE RACE FOR THE ELGIN NATIONAL TROPHY FOR CARS 450 INCHES

No.	Car	Driver	Entrant		1 8 Miles 2030 Ft.	2 16 Miles 4060 Ft.	3 25 Miles 810 Ft.	4 33 Miles 2840 Ft.	5 41 Miles 4870 Ft.	6 50 Miles 1620 Ft.	7 58 Miles 3650 Ft.	8 67 Miles 400 Ft.	9 75 Miles 2430 Ft.	10 83 Miles 4460 Ft.	11 92 Miles 1210 Ft.	12 100 Miles 3240 Ft.	13 108 Miles 5270 Ft.	14 117 Miles 2020 Ft.	15 125 Miles 4050 Ft.	16 134 Miles 800 Ft.
1	Case	W. Endicott	J. Alex Sloan	El. Time	7:31	14:53	22:25	30:15	38:08	45:57	53:50	61:32	69:26	77:16	85:12	92:51	100:28	108:25	116:20	124:10
				Lap Time	7:31	7:22	7:32	7:50	7:53	6:49	7:53	7:42	7:54	7:50	7:57	7:38	7:37	7:57	7:55	7:50
2	Mason	Rickenbacher	F. E. Duesenberg	El. Time	Out of race—Broken Axle.															
				Lap Time																
3	Mason	Mulford	Ralph Mulford	El. Time	7:16	14:29	21:40	28:55	36:10	43:19	50:31	57:44	64:51	71:57	79:09	86:20	93:32	100:33	107:38	114:44
				Lap Time	7:16	7:13	7:11	7:15	7:15	7:9	7:12	7:13	7:73	7:6	7:12	7:11	7:12	7:1	7:5	7:6
4	Mercer	Wishart	Mercer Auto Co	El. Time	6:51	13:29	20:11	29:21	36:09	44:35	51:36	58:29	65:17	72:05	78:56	85:43	92:30	99:17	106:05	114:46
				Lap Time	6:51	6:38	6:42	9:10	6:48	8:26	7:1	6:53	6:48	6:48	8:51	6:47	6:47	6:47	6:48	8:41
5	Stutz	Anderson	R. E. Maypole	El. Time	7:07	13:58	20:48	27:37	34:28	41:24	48:16	55:06	61:57	68:47	75:38	82:27	89:18	96:02	102:52	109:35
				Lap Time	7:07	6:51	6:50	6:49	6:51	6:56	6:52	6:50	6:51	6:50	6:51	6:49	6:51	6:44	6:50	6:43
6	Marmon	Dawson	Charles Erbstein	El. Time	7:44	16:26	25:32	35:14	42:15	49:14	56:06	63:02	71:36	78:31	85:25	92:24	99:21	108:59	116:02	124:29
				Lap Time	7:44	8:42	9:06	9:42	7:1	6:59	6:52	6:56	8:34	6:55	6:54	6:59	6:57	8:38	7:03	8:27
7	Mason	Haupt	F. E. Duesenberg	El. Time	7:35	14:56	22:15	29:34	36:53	44:08	51:26	58:31	65:35	73:08	80:21	87:24	94:37	104:05	111:05	119:21
				Lap Time	7:35	7:21	7:19	7:19	7:19	7:16	7:18	7:5	7:04	7:33	7:13	7:3	7:13	9:28	7:00	8:16
8	Keeton	Burman	E. A. Moross	El. Time	7:17	14:39	21:58	29:14	36:33	43:52	51:07	58:24	65:39	72:51	80:10	87:30	94:50	102:08	109:35	117:03
				Lap Time	7:17	7:22	7:19	7:16	7:19	7:19	7:15	7:17	7:15	7:12	7:19	7:20	7:20	7:18	7:27	7:28
12	Velie	Henning	Otto Henning	El. Time	8:33	24:44	49:45	58:49												
				Lap Time	8:33	16:11	25:01	9:04												
14	Mercer	DePalma	Mercer Auto Co.	El. Time	7:24	14:46	22:18	29:48	37:19	44:56	52:24	59:51	67:25	74:57	82:32	89:46	97:21	104:46	111:51	119:13
				Lap Time	7:24	7:22	7:32	7:30	7:31	7:37	7:28	7:27	7:34	7:32	7:35	7:14	7:35	7:25	7:05	7:22
15	Isotta	Grant	W. Ziegler, Jr.	El. Time	7:35	15:03	22:30	30:2	37:32	45:06	52:45	60:18	67:55	75:39	83:22	91:07	98:51	106:31	114:17	122:02
				Lap Time	7:35	7:28	7:27	7:32	7:30	7:34	7:39	7:33	7:37	7:44	7:43	7:45	7:44	7:40	7:46	7:45
16	Erwin Spl.	Bergdoll	Erwin Bergdoll	El. Time	7:21	15:51	23:00	30:10	37:27	44:44	51:50	59:3	66:10	73:23	80:37	87:56	95:08	102:27	109:38	116:50
				Lap Time	7:21	8:30	7:09	7:10	9:17	7:17	7:6	7:13	7:7	7:13	7:14	7:19	7:12	7:19	7:11	7:12



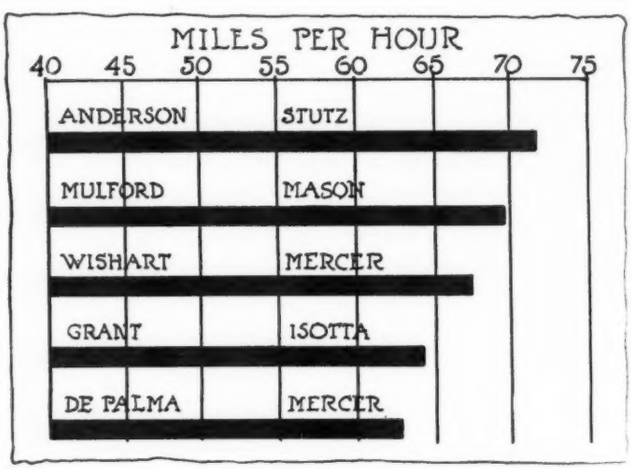
Wishart in Mercer on homestretch in Elgin National Race making fastest lap ever driven on Elgin circuit, going 8 miles and 2030 feet in 6:38, speed 75.85 miles per hour. Piston displacement 448 cubic inches

sent away at 30-second intervals by Starter Wagner. For the first three laps Spencer Wishart took the lead, only to give way to Anderson's Stutz in the fourth circuit which was never headed out of first place and finished with a margin of nearly 7 minutes over Mulford, who took second money with a Mason. Mulford averaged 69.5 miles per hour. Mulford's performance was a remarkable one in that he used a motor with but 299 cubic inches, although the race was limited to cars of 450 cubic inches.

Third honors were captured by Spencer Wishart in a Mercer, averaging 67.5 miles per hour and finishing 15 minutes back of Anderson. Wishart in addition to finishing third carried off the $200 prize for the fastest lap, the fastest circuit ever made on the course.

Two other contestants finished, Grant in the Isotta fourth and De Palma in the Mercer fifth. Grant's Isotta averaged 64.1 miles per hour and made a most consistent run, not stopping until the thirtieth lap when he took on fuel and oil. His speed was a disappointment, his fastest lap being at 69.3 miles per hour.

Of the twelve starters, these five finished.



Comparative chart of speeds of the Elgin trophy leaders

TABLE OF RACE FOR CHICAGO AUTOMOBILE CLUB TROPHY FOR CARS OF 300 INCHES DIS

No.	Car	Driver	Entrant		1 8 Miles 2030 Ft.	2 16 Miles 4060 Ft.	3 25 Miles 810 Ft.	4 33 Miles 2840 Ft.	5 41 Miles 4870 Ft.	6 50 Miles 1620 Ft.	7 58 Miles 3650 Ft.	8 67 Miles 400 Ft.	9 75 Miles 2430 Ft.	10 83 Miles 4460 Ft.	11 92 Miles 1210 Ft.	12 100 Miles 3240 Ft.	13 108 Miles 5270 Ft.	14 117 Miles 2020 Ft.	15 125 Miles 4050 Ft.	16 134 Miles 800 Ft.
20	Deltal	Dawson	E. H. Delling	El. Time	7:25	14:44	21:57	29:10	36:24	43:33	50:37	59:43	66:57	74:18	83:35	90:52	98:07	105:21	112:35	119:51
				Lap Time	7:25	7:19	7:13	7:13	7:14	7:09	7:04	9:06	7:14	7:21	9:17	7:17	7:15	7:14	7:14	7:16
21	Mercer	DePalma	Mercer Auto Co.	El. Time	7:25	14:40	21:57	29:08	36:15	43:29	50:43	57:52	65:08	72:17	79:30	86:39	93:57	101:21	109:50	117:26
				Lap Time	7:25	7:15	7:17	7:11	7:07	7:14	7:14	7:09	7:16	7:09	7:13	7:09	7:18	7:24	8:38	7:27
24	Mason	Chandler	F. E. Duesenberg	El. Time	8:06	16:30	23:54	31:54	41:29	49:12	56:58	64:48	98:11	106:08	113:55	121:51	129:48	137:45	145:48	153:42
				Lap Time	8:06	8:24	7:24	8:00	9:35	7:43	7:46	7:50	33:23	7:57	7:47	7:56	7:57	7:57	8:03	7:54
25	Endicott Special	H. Endicott	E. A. Moross	El. Time	8:57	17:34	26:08	34:46	43:19	52:04	65:25	75:36	84:21	93:24	102:15	111:09	120:06	130:17	138:51	147:42
				Lap Time	8:57	8:77	8:34	8:38	8:33	8:45	13:21	10:11	8:45	9:03	8:51	8:54	8:57	10:11	8:34	8:51
22	Mason	Rickenbacher	F. E. Duesenberg	El. Time	7:27	14:27	21:38	28:43	35:57	43:09	50:23	57:40	101:40	112:32	122:47	132:26	142:38	151:33	160:28	169:43
				Lap Time	7:27	7:00	7:11	7:05	7:14	7:12	7:14	7:17	44:00	11:12	9:55	9:39	10:12	8:55	8:55	9:15
23	Mercer	Wishart	Mercer Auto Co.	El. Time	7:36	19:27	26:52	34:10	41:34	48:51	56:07	64:29	71:54	79:11	86:29	96:19	105:27	113:00	122:14	159:21
				Lap Time	7:36	11:51	7:25	7:18	7:24	7:17	7:16	8:22	7:25	7:17	7:18	9:30	9:08	7:33	9:14	7:07
27	Mercer	Luttrell	Mercer Auto Co.	El. Time	8:23	16:36	24:43	32:49	40:54	48:55	98:44	128:47	137:06	145:12	153:18	161:26	169:32	177:31		
				Lap Time	8:23	8:13	8:07	8:06	8:05	8:01	49:49	30:03	8:19	8:06	8:06	8:08	8:06	7:59	Out-	Burned
26	Mason	Mulford	F. E. Duesenberg	El. Time	7:19	14:29	21:41	28:54	36:04	43:10	50:11	57:18	64:23	71:34						
				Lap Time	7:19	7:10	7:12	7:13	7:10	7:06	7:01	7:07	7:05	7:11	Out—Flywheel studs sheared off					

DISPLACEMENT AND UNDER, HELD AT THE FOURTH ANNUAL ELGIN ROAD RACES, AUGUST 29-30

17 142 Miles 2830 Ft.	18 150 Miles 4860 Ft.	19 159 Miles 1610 Ft.	20 167 Miles 3640 Ft.	21 176 Miles 390 Ft.	22 184 Miles 2420 Ft.	23 192 Miles 4450 Ft.	24 201 Miles 1200 Ft.	25 209 Miles 3230 Ft.	26 217 Miles 5260 Ft.	27 226 Miles 2010 Ft.	28 234 Miles 4040 Ft.	29 243 Miles 790 Ft.	30 251 Miles 2820 Ft.	31 259 Miles 4850 Ft.	32 268 Miles 1600 Ft.	33 276 Miles 3630 Ft.	34 285 Miles 380 Ft.	35 293 Miles 2410 Ft.	36 301 Miles 4440 Ft.	Pos. at Fin.	Mi. per Hr.
132:03	139:50	147:42	155:24	163:08	170:43	178:23	220:57	229:10	238:47	247:03	258:09	266:43	275:17	283:54							
7:53	7:47	7:52	7:42	7:44	7:35	7:40	42:34	8:13	9:37	8:16	11:06	8:34	8:34	8:37							
121:49	128:59	136:06	143:12	150:25	157:35	166:27	173:43	180:49	188:46	195:55	203:07	210:25	217:35	224:46	231:56	239:04	246:14	253:22	260:31:25	2	69.7
7:05	7:10	7:7	7:6	7:13	7:10	8:52	7:16	7:6	7:57	7:9	7:12	7:18	7:10	7:11	7:10	7:18	7:10	7:08	7:09		
121:40	129:12	135:57	142:38	054:34	161:24	168:08	176:34	184:07	193:57	200:46	207:30	214:14	225:15	232:09	238:55	247:50	254:37	263:06	269:58:95	3	67.5
6:54	7:32	6:45	6:41	11:56	6:50	6:44	8:26	7:33	9:50	6:49	6:44	6:51	10:54	6:54	6:46	8:55	6:47	8:29	6:52		
117:36	124:33	131:25	138:18	146:54	154:49	164:13	171:21	178:21	185:14	192:08	198:58	205:52	212:39	219:30	226:22	233:13	240:00	246:50	253:38:97	1	71:4
8:01	6:57	6:52	6:53	8:36	7:55	9:24	7:8	7:00	6:53	6:54	6:50	6:54	6:47	6:51	6:52	6:51	6:47	6:50	6:38		
131:27	138:24	150:03	158:41	165:43	172:39	179:40	186:43	193:47	200:51	210:15	228:24	235:50	245:19	255:34	263:27	270:28	277:43	284:57			
6:58	6:51	11:39	8:38	7:2	6:56	7:1	7:3	7:4	7:4	9:24	18:09	7:26	9:29	10:15	7:53	7:01	7:15	7:14			
126:26	133:35	140:42	147:46	154:48	161:57	169:14	176:32	184:01	195:30	209:50	221:19	241:33	250:59								
7:5	7:9	7:7	7:4	7:2	7:09	7:17	7:18	7:29	11:29	14:20	11:29	20:14	9:26								
124:24	131:54	141:15	} Out—broken cylinder																		
7:21	7:30	9:21																			
126:29	133:44	141:05	149:27	157:05	164:20	171:44	179:19	186:55	194:29	203:19	212:39	220:32	239:57	247:43	355:34	263:34	271:27	279:28	287:24:38		63.1
7:16	7:15	7:21	8:22	7:38	7:15	7:24	7:35	7:36	7:34	8:50	9:20	7:53	19:25	7:46	7:53	8:12	7:53	8:01	7:56		
129:50	137:35	145:20	153:7	161:22	169:16	177:17	185:02	192:45	200:38	208:38	216:38	244:46	233:33	241:41	249:40	257:43	265:46	273:59	282:14:10		64.3
7:48	7:45	7:45	7:47	8:15	7:54	8:1	7:45	7:43	7:53	8:00	8:00	8:08	8:47	8:8	7:59	8:03	8:03	8:13	8:15		
124:09	132:07	141:56	149:02	156:24	163:26	170:24	177:29	184:40	191:57	199:09	206:20	213:36	220:50	228:14	} Out						
7:19	7:58	8:49	7:6	7:22	7:2	6:58	7:5	7:11	7:17	7:12	7:11	7:16	7:14	7:24							

W. Endicott in the Case was running in his thirty-second lap when flagged off by Starter Wagner. His running was most consistent excepting for a long stop in lap twenty-four when he lost over 20 minutes putting a new breaker box on the magneto. He made his fastest lap at 73.8 miles per hour.

Five cars failed to finish for one cause or another. Erwin Bergdoll drove a good race but ran out of gasoline in lap thirty-two and withdrew. He was a contender for third and fourth positions until his withdrawal.

Burman's Keeton did not show the looked for speed and was withdrawn in the middle of the race with cracked cylinders. Its fastest lap was 69.3 miles per hour. Haupt in a Mason completed thirty laps and withdrew with engine troubles. Henning driving a Velie completed but four laps;

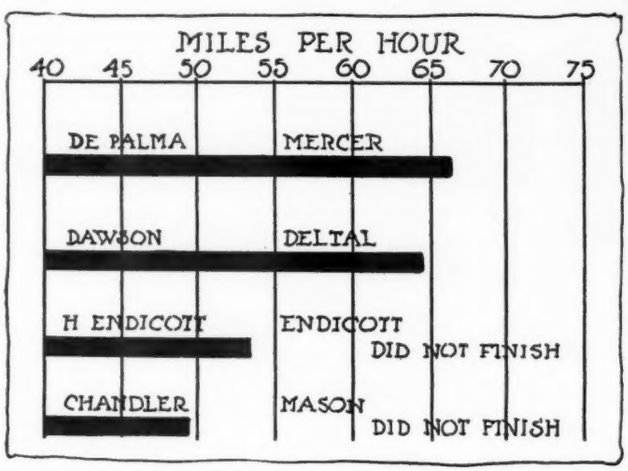


Chart of the fastest speeds made in the Chicago A. C. race

Rickenbacher in Mason making the fastest lap in the Chicago Automobile Club trophy race, making 8 miles 2030 feet in 7:00, speed 71.9 miles per hour, piston displacement 299 cubic inches

and Rickenbacher in a Mason went into the ditch in the first lap.

Today's racing was the best ever seen in the west and the record crowd of 50,000 set a new attendance mark. The day was fine and the course in fair shape.

The course was faultlessly guarded from start to finish, the

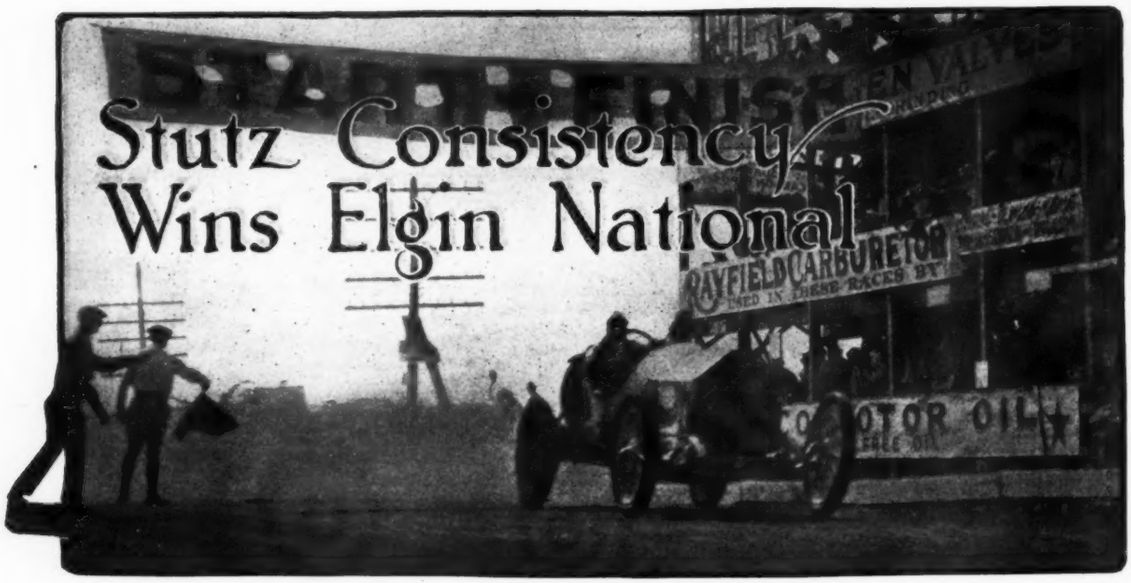
(*Continued on page 412.*)

PLACEMENT AND UNDER HELD AT THE FOURTH ANNUAL ELGIN ROAD RACES, AUGUST 29-30

17 142 Miles 2830 Ft.	18 150 Miles 4860 Ft.	19 159 Miles 1610 Ft.	20 167 Miles 3640 Ft.	21 176 Miles 390 Ft.	22 184 Miles 2420 Ft.	23 192 Miles 4450 Ft.	24 201 Miles 1200 Ft.	25 209 Miles 3230 Ft.	26 217 Miles 5260 Ft.	27 226 Miles 2010 Ft.	28 234 Miles 4040 Ft.	29 243 Miles 790 Ft.	30 251 Miles 2820 Ft.	31 259 Miles 4850 Ft.	32 268 Miles 1600 Ft.	33 276 Miles 3630 Ft.	34 285 Miles 380 Ft.	35 293 Miles 2410 Ft.	36 301 Miles 4440 Ft.	Miles per Hour
127:06	134:24	141:42	152:13	159:36	169:45	177:13	184:33	191:58	199:20	206:46	214:06	224:54	232:21	239:56	247:19	254:44	262:06	271:11	279:52.75	
7:15	7:18	7:18	10:31	7:23	10:09	7:28	7:20	7:25	7:22	7:26	7:20	10:48	7:27	7:35	7:23	7:25	7:22	9:05	8:41	
124:43	132:04	139:29	149:46	157:27	164:54	172:20	179:45	187:15	195:02	202:52	210:26	217:57	226:07	233:53	241:30	249:08	256:44	264:18	271:56.90	66.3
7:17	7:21	7:25	10:17	7:41	7:27	7:26	7:25	7:30	7:47	7:50	7:34	7:31	8:10	7:46	7:37	7:38	7:36	7:34	7:38	
161:35	169:28	182:53	195:19	203:44	211:36	219:58	228:13	236:15	244:18	258:45	267:04	275:14	283:52	294:07	302:33					
7:53	8:53	13:25	12:26	8:25	7:52	8:22	8:15	8:02	8:03	14:27	8:19	8:10	8:38	10:15	8:26	Running when flagged				
156:11	166:40	175:15	183:51	192:26	201:06	209:59	219:48	227:34	236:12	245:00	254:29	268:44	282:19							
8:29	10:29	8:35	8:36	8:35	8:40	8:53	9:49	7:46	8:38	8:48	9:29	14:15	13:35	Stopped—Driver ill						
180:05	193:36	203:28	215:10	227:29	239:34	249:39	259:42	269:20	279:27	297:27										
10:22	13:31	9:52	11:42	12:19	12:05	9:59	10:05	9:38	10:07	18:00	Running at finish									
168:28	185:01	192:35	200:01	207:26	214:52	222:23														
9:07	16:33	7:34	7:26	7:25	7:26	7:31	Out—Broken spring													

out motor bearing

Stutz Consistency Wins Elgin National



Stutz crossing the finishing line a record-breaking winner in the Elgin National Trophy Race

SECOND DAY	
Anderson	Mulford
7:07	7:16
6:51	7:13
6:50	7:11
6:49	7:15
6:51	7:15
6:56	7:09
6:52	7:12
6:50	7:13
6:51	7:07
6:50	7:06
6:54	7:12
6:49	7:11
6:51	7:12
6:44	7:01
6:50	7:05
6:43	7:06
8:01	7:05
6:57	7:10
6:52	7:07
6:53	7:06
7:36	8:13
7:55	7:10
9:24	8:52
7:08	7:16
7:00	7:06
6:53	7:57
6:54	7:09
6:50	7:12
6:54	7:18
6:47	7:10
6:51	7:11
6:52	7:10
6:51	7:18
6:47	7:10
6:50	7:08
6:48	7:09

GIL ANDERSON in the Stutz really made it a runaway in the Elgin National trophy race, the one event on the second day. Second for the first three laps, he then took command from that point and to the end of the race he never let any of his rivals get close enough to even make it interesting. Running with remarkable regularity, he got among the course records from the start and finished the thirty-six laps with an average of 71.4 miles per hour, which made the 68.9 in last year's free-for-all look comparatively slow.

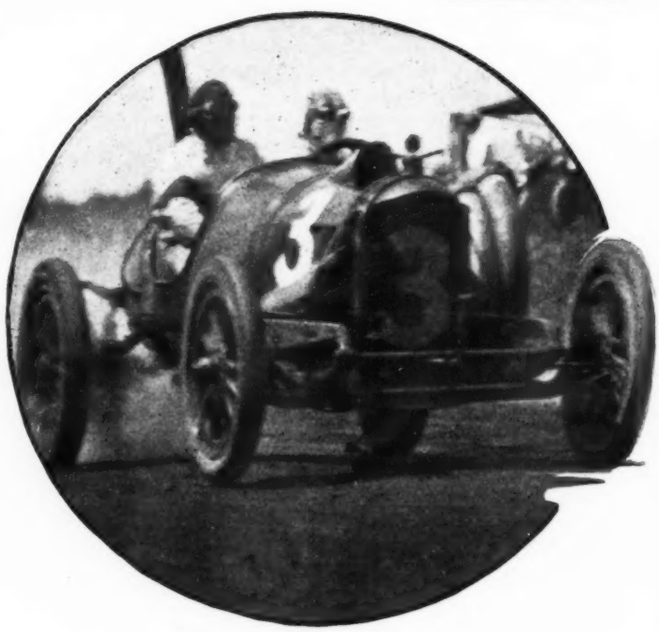
Anderson kept increasing his pace at the end, much to the surprise of the spectators who had expected him to play safe. Each of his last eleven laps was under 7 minutes and he wound up with 6:48, which was only 10 seconds slower than Wishart's circuit, the fastest of the course.

Mulford, however, was the surprise of the day. Driving the same little car he had piloted in the 300 and under race, Mulford was always a contender and in position to take advantage of any misfortune that might overtake Anderson. He never moved faster than 7:01, yet he managed to land second place. As he did at Indianapolis, he went through the entire race without a tire change. Wishart, too, was always in the fight and, like Mulford, well placed to go to the front in case anything happened to the leaders. He and Mulford see-sawed for a long time, first one being second and then dropping to third.

The race really divided itself into three groups. Anderson, Mulford, Wishart, Haupt and Burman were in the first flight; then came the heavy artillery, De Palma, Grant and Bergdoll, never dangerous but always in motion, while in the far rear were Bill Endicott and Joe Dawson. Haupt and Burman kept interchanging positions with great regularity until both went out, Burman with cracked cylinders.

When the race was one-quarter done, the order was Anderson, Mulford, Wishart, Haupt, Burman, Bergdoll, De Palma, Grant, Endicott and Dawson. Henning in the Velie, poorly equipped for the struggle, had quit after four laps. Anderson was nearly 3 minutes ahead of Mulford and the field was well bunched, there being only a little more than 6 minutes between first and eighth. Really it was any one's race and in consequence the crowd was intensely interested.

At the half-way mark Anderson still led Mulford with Wishart third, while Burman had passed Haupt, who had dropped to sixth, Bergdoll slipping into fifth. Grant and De Palma still were seventh and eighth, while Dawson brought up the rear. Anderson had increased his lead over Mulford and was 4 minutes 26 seconds to the good, notwithstanding he had made his first stop at the pits at the end of the seventeenth lap to take on gasoline and oil, using 1 minute. Mulford had not stopped and was plugging along with a persistency that worried admirers of the Stutz. Grant in the Isotta also had a perfect score as regards stops, while Bill Endicott went sixteen laps before he pulled up at the pits.



Mulford in the Mason came in second

The next quarter section saw Burman drop by the wayside. Bob seemed to lack his customary dash and while he had been a contender he did not look dangerous. He stopped at the pits in the nineteenth lap to take on oil and gasoline and tighten his shock-absorbers and on the next lap he deserted the ship in the back stretch and walked back to the stands, having withdrawn.

At the end of the twenty-sixth lap the order was Anderson, Mulford, Bergdoll, Wishart, De Palma, Haupt, Grant, Dawson and Bill Endicott, Anderson leading Mulford by 3 minutes 32 seconds, Mulford having crept up on him a bit. It was in this section that Mulford made his first stop, using up 1 minute and

26 seconds to take on oil and gasoline and turn a spring shackle. This was at the end of the twenty-third lap.

From this point on to the end of the race it was only a question of how much Anderson would win by. Evidently instructed to speed, he never went slower than 7 minutes to the lap, his times being 6:53, 6:54, 6:50, 6:47, 6:51, 6:52, 6:51, 6:52, 6:51, 6:47, 6:50 and 6:48. When he got the checkered flag he was 7 minutes 31 seconds ahead of Mulford, who led Wishart by more than 9 minutes. De Palma and Grant were fighting it out for fourth, the latter getting the decision. Dawson and Endicott were running but not far enough up to finish. Bergdoll had been eliminated through running out of gasoline when it looked as if he would be in the money. He was third when he stopped in the thirty-second lap.

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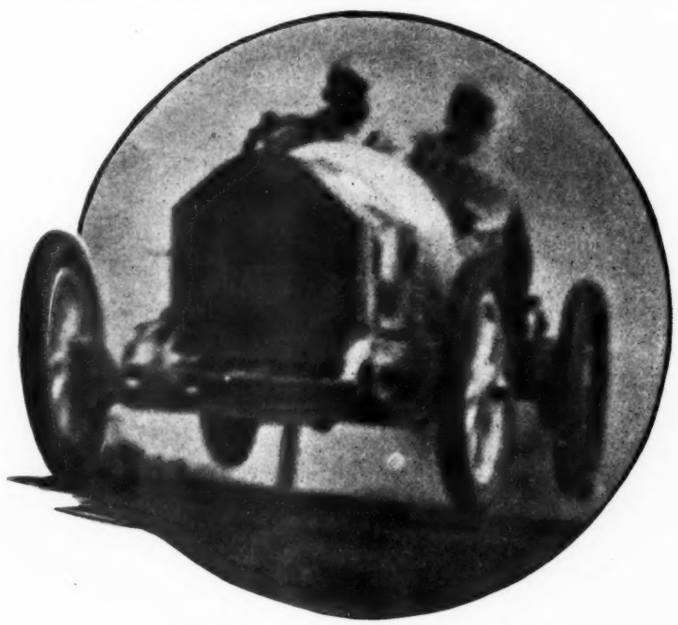
Mulford Drives His Mason Entire Distance Without Tire Changes

THE feature of Saturday's race from the standpoint of the repair pits is the showing of Mulford's Mason, which went the entire distance without change of tires, and also the fact that these tires were the same four which carried him during the 95 miles of Friday's race and events at Galveston. This in connection with the fact that he kept up a pace fast enough to bring him in second makes Mulford's tire record compare favorably with that he made at Indianapolis Memorial Day. Mulford made only one stop and this after he had gone 192 miles, when he took on gasoline and oil. He had no mechanical difficulties, although occasion was taken at this time to straighten out a spring shackle which had turned over.



Stutz car with the rear wheels in the air

Anderson's Stutz, which finished first, made only four stops at the repair pits and only two of these were occasioned by necessity for tire changes, and none for mechanical difficulties. The first was in the seventeenth lap when he halted for 1 minute to refill his gasoline and oil tank. The second was in the twenty-first lap when he changed a left rear tire, which held him for nearly 2 minutes. The third stop was to refill the oil tank and he was away in 31 seconds. His fourth and last stop was occasioned by a tire change made on the back stretch, so that he had to put a new spare on the rack at the pit. This held him only 19 seconds and was a record for the day. Anderson's stops totaled only 3 minutes and 45 seconds for time lost at the pits.

Wishart's bad luck of Friday followed him during the next day's races so far as tire troubles were concerned. He changed twelve tires during the 300 miles and lost 8 minutes at the pits on account of tire trouble. At that, he won third money. He made no stops at any time for any other reason except tires. Only once did he take on water.

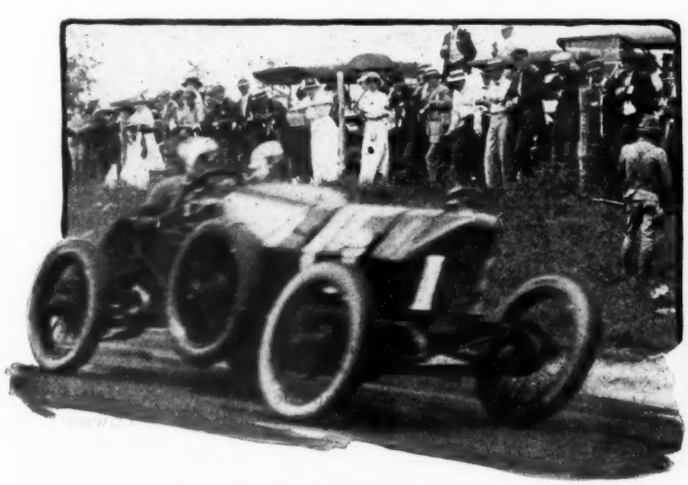
Grant in the Isotta made a record that rivals that of Mulford, as he made only one stop, and that after running 250 miles, to refill his gasoline and oil tanks. He made no tire changes throughout the race, had no mechanical trouble that necessitated stops, and did not take on any water.

De Palma's Mercer made nearly as good a record as far as tire troubles are concerned as did Grant and Mulford. De Palma changed only one tire, that one being the left rear after he had run 235 miles. He ran the first 167 miles without a stop, but in the twentieth lap halted for 52 seconds to fill his tanks with water, oil and gasoline. In the thirtieth lap he again took on water and gasoline and at the same time cleaned out the gasoline line which had given evidences of having dirt in it. A new gasket was placed under the inlet manifold, the whole stop taking 10½ minutes. De Palma made four stops in all, losing 13 minutes and 21 seconds.

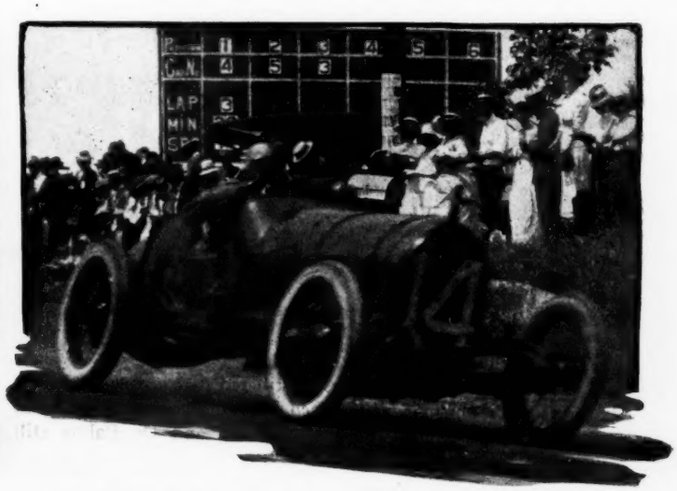
The Marmon driven by Dawson halted four times at the pits: three times for tire changes and once for gasoline and oil. At two of these stops Dawson tinkered with the carbureter and lost about 7 minutes altogether.

Bergdoll in his Erwin Special had made only two stops in the 260 miles he covered before he ran out of gasoline on the back stretch. Neither one of these was occasioned by tire

(*Continued on page* 413)



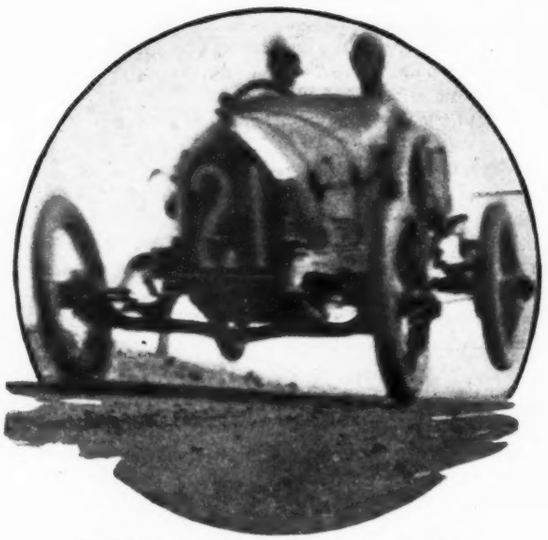
Grant in the Isotta car made an excellent showing



De Palma in the Mercer car which captured the C. A. C.

De Palma Winner of C. A. C. Trophy

Covers Course at Average of Only 66.3 Miles Per Hour—6 Minutes Between First and Eighth Car



De Palma, winner of the C. A. C. trophy

HAD Rickenbacher and Mulford of the Mason team stayed in the first day's race, De Palma probably would have had the fight of his life to bring home the Chicago Automobile Club trophy for the Mercer. The Masonites made it merry for their great rival while they were going and the race was nearly one-third gone before De Palma was able to get to the front. But after the elimination of the two sprinters it was a comparatively easy task for the Mercer man to plug along to victory. Dawson stuck back of De Palma in his usual bulldog manner, but he never got the Deltal close enough to the Mercer to worry De Palma.

From the very first Mulford and Rickenbacher started to beat it, the latter taking the initiative, traveling his first lap in 7:19 from a standing start. Then Rickenbacher took up the running and taking all sorts of chances he went to the front and burned up the road. He stayed up in front to the seventh lap, when Mulford became demonstrative and ousted him. At this stage De Palma was third, Dawson fourth, Wishart fifth, with the others struggling hard to hold the terrific pace. Wishart had made one stop at the pits—in the second lap—to take on water and gasoline, while Chandler stopped in the fourth lap to fix a battered rim, caused by running flat. Chandler was delayed 24 minutes and let the field get away from him.

The hot pace told on Rickenbacher and in the ninth lap he stopped nearly 5 minutes to put in a new valve, leaving it to Mulford to uphold the reputation of the Mason. This Mulford was willing to do, but not for long. In the eleventh lap, at which point he had maintained an average of better than 70 miles an hour, he sheared the bolts off his flywheel and he was out. It first was thought he had broken a crankshaft but this proved not to be the case.

The elimination of Mulford and Rickenbacher robbed the race of its chief interest. De Palma evidently had counted on their coming back to him, for he had been plugging along phlegmatically, not stopping until he had gained the front. In the fifteenth lap he stopped at the pits to change a right rear, and again in the twentieth to take on gasoline, oil and a spare tire.

Dawson also had figured the same way as De Palma, for he, too, was not driving with his customary dash. When De Palma went into the lead in the eleventh lap Dawson became runner-up and from this point to the end of the race no one broke in between the pair. Rickenbacher did not quit until the twenty-eighth lap, but he never got among the leaders again. Wishart did not live up to the promise he gave in practice, and although he kept away from the tail-enders he was wasting a lot of time at the pits. He had nine stops, at one time being held up 24 minutes changing a front spring. Finally another spring went and he stopped while in the twenty-fifth lap.

FIRST DAY	
DePalma	Dawson
7:25	8:25
7:15	7:19
7:17	7:13
7:11	7:13
7:07	7:14
7:14	7:09
7:14	7.04
7:09	9:06
7:15	7:14
7:09	7:21
7:13	9:17
7:09	7:17
7:18	7:15
7:24	7:14
8:38	7:14
7:27	7:16
7:17	7:15
7:21	7:18
7:25	7:18
10:17	10:31
7:41	7:23
7:27	10:09
7:26	7:28
7:25	7:20
7:30	7:25
7:47	7:22
7:50	7:26
7:34	7:20
7:31	10:48
8:10	7:27
7:46	7:35
7:37	7:23
7:38	7:25
7:36	7:22
7:34	9:05
7:38	8:41

The tail-enders had a hard time of it. Luttrell, a Chicago amateur, brought up the rear and finally withdrew in the fifteenth lap because of burned-out connecting-rod bearings due to an inoperative oil pump. Harry Endicott, in the Endicott Special, although he kept moving along, found it so hard because of the bucket seats he had fitted to his car that he was forced to withdraw from the race in the thirty-first lap from exhaustion. Earlier than this he had to change mechanics because Madden was worn out. Added to these complications, his car caught fire in the backstretch just before he quit.

It cannot be said that this was an interesting race after the Masons went out. In fact it was monotonous. De Palma got the checkered flag when he was 8 minutes ahead of Dawson—more than a lap. Really there was no third, for Chandler was so far in the rear that it is likely the patience of the crowd would not have stood the strain if he had been allowed to finish. When Chandler was in his thirty-second lap a flagman over in the backstretch became confused and wig-wagged

Joe Dawson, Deltal, who was second in the C. A. C. race at 64.7 miles per hour

De Palma, Mercer No. 21, overhauling Luttrell, Mercer No. 27, on the homestretch in the C. A. C. trophy race. Luttrell was later eliminated by a burned out motor bearing, caused by lack of a hole in the oil filler cap

that the race was over. The crowd started to come out on the course, so there was nothing else to do but stop Chandler and give him third place.

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De Palma's Record of Fewest Stops at Pits a Factor

THAT a race often is won as much by the elimination of time lost at the repair pits as by great speed on the course was both proven and disproven at Elgin. Friday's event bore out the maxim that he who would win must keep going, for De Palma, the first to receive the finish flag, made fewer stops than the others whose mounts did not succumb to the pace. As a contradiction to this, Saturday's race saw Anderson win over Mulford, although the latter made but one stop, whereas his victorious rival halted at his pits four different times.

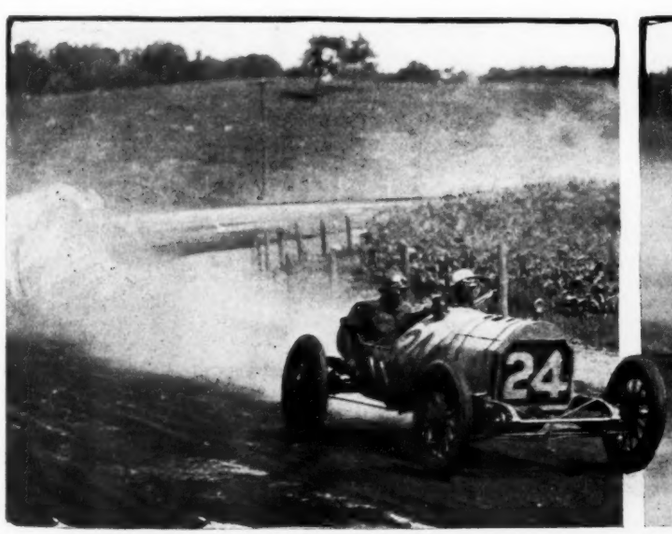
Although there were nearly twice as many cars in the second day's event as started Friday, the pit stops for supplies or repairs were nearly as frequent on the first day as on the last. This is attributed to the fact that it was necessary to work the smaller motors of Friday's race harder to keep the pace that was maintained. The larger motors of Saturday did not have to be speeded up so high and consequently motor troubles were less frequent and stops correspondingly fewer.

The small-car race for the C. A. C. trophy on Friday did not develop so much tire trouble as did the Elgin trophy race, chiefly because the cars were lighter. Of the cars that lasted through Friday's event, De Palma's Mercer, the winner, made the fewest stops at the pits. The Italian-American ran 134 miles without a halt, but at the end of the fifteenth lap he pulled in at his pit and changed the right rear wheel as the tire was beginning to show the effect of the furious pace. This delayed him only 52 seconds and was his only stop for wheel replacement at the pits. However, in the twentieth lap he had to change another tire on the back stretch and so stopped at the pits at the end of that round to put a new spare wheel on his rack. Advantage was taken of this stop to fill the oil and gasoline tanks, but the whole operation held him at the pits for only 54 seconds. De Palma's third and last pit stop was at the end of the thirtieth round of the 8-mile course after he had run 250 miles. This was hardly a stop—merely a hesitation—for a can of gasoline was upended in his tank before the wheels had stopped revolving and the yellow Mercer was on the course again in 25 seconds. De Palma lost only 2 minutes and 11 seconds during his three stops at the pits—the record for the day so far as lost time was concerned. Only two tires were changed on the victorious Mercer, and there was no mechanical trouble whatever.

Dawson likewise made only three stops the first day, and likewise only two of these were caused by tire troubles, but the Deltal was held longer at the pits each time than was the Mercer. Dawson's time lost at the pits totaled 6 minutes and 20 seconds, almost three times as long as De Palma's. The Indianapolis boy's delay was due to the slower pitwork of the Deltal crew. Dawson made his first stop at the end of the tenth lap when he changed a right rear tire and took on water. This held him 1 minute 41 seconds.

After twelve more laps he stopped for 2 minutes and 18 seconds while spare wheels were changed due to a replacement on the back stretch, and fresh supplies of gasoline and water were taken on. The last stop for the Deltal was necessitated by the loosening of the throttle lever connection. The opportunity

(*Continued on page* 413)



Chandler's Mason in the C. A. C. trophy race.

Wishart, in Mercer No. 23, passing De Palma on hairpin turn

TABLE SHOWING THE POSITION BY LAPS OF THE CONTESTANTS IN THE ELGIN NATIONAL TROPHY RACE FOR CARS

No.	Car	Driver	Entrant		1 8 Miles 2030 Ft.	2 16 Miles 4060 Ft.	3 25 Miles 810 Ft.	4 33 Miles 2840 Ft.	5 41 Miles 4870 Ft.	6 50 Miles 1620 Ft.	7 58 Miles 3650 Ft.	8 67 Miles 400 Ft.	9 75 Miles 2430 Ft.	10 83 Miles 4460 Ft.	11 92 Miles 1210 Ft.	12 100 Miles 3240 Ft.	13 108 Miles 5270 Ft.	14 117 Miles 2020 Ft.
1	Case	W. Endicott	J. Alex Sloan	El. Time														
				Lap Time	7	6	7	9	9	9	9	9	9	9	9	9	10	9
2	Mason	Rickenbacher	F. E. Duesenberg	El. Time														
				Lap Time	Out in first lap													
3	Mason	Mulford	Ralph Mulford	El. Time														
				Lap Time	3	3	3	2	3	2	2	2	2	2	3	3	3	3
4	Mercer	Wishart	Mercer Auto. Co.	El. Time														
				Lap Time	1	1	1	4	2	5	5	4	3	3	2	2	2	2
5	Stutz	Anderson	R. E. Maypole	El. Time														
				Lap Time	2	2	2	1	1	1	1	1	1	1	1	1	1	1
6	Marmon	Dawson	Charles Erbstein	El. Time														
				Lap Time	10	10	10	10	10	10	10	10	10	10	10	10	9	10
7	Mason	Haupt	F. E. Duesenberg	El. Time														
				Lap Time	8	7	5	5	5	4	4	5	4	5	5	5	4	6
8	Keeton	Burman	E. A. Moross	El. Time														
				Lap Time	4	4	4	3	4	3	3	3	5	4	4	4	5	4
12	Velie	Henning	Otto Henning	El Time														
				Lap Time	11	11	11	11	Out									
14	Mercer	DePalma	Mercer Auto. Co.	El. Time														
				Lap Time	6	5	6	6	6	7	7	7	7	7	7	7	7	7
15	Isotta	Grant	W. Ziegler, Jr.	El. Time														
				Lap Time	8	8	8	7	7	8	8	8	8	8	8	8	8	8
16	Erwin Spl.	Bergdoll	Erwin Bergdoll	El. Time														
				Lap Time	5	9	9	8	8	6	6	6	6	6	6	6	6	5

Stutz Wins Elgin Classic

(*Continued from page 407*)

militia under Colonel Green not permitting a spectator to cross the road or to get between the fences from the closing of the course until five cars had finished and the other two that were running were flagged off.

Friday's Race Fast

In yesterday's race for the Chicago Automobile Club trophy eight starters were sent away. De Palma, the eventual winner, did not get into the lead until nearly 100 miles, one-third of the race, had been covered and once in first position he was never headed off and finished with a leeway of nearly 8 minutes over Dawson driving the new Deltal car. Dawson drove a most consistent race from start to finish, but had trouble with his carbureter float and tires, losing much time by both. He averaged 64.7 miles per hour for the distance.

Of the six other cars several played important parts during the struggle but all were eliminated but two before the completion these being Chandler and Rickenbacher, driving Mason machines. Chandler, although not finished, was flagged off and given third place. Rickenbacher was also flagged off.

Spencer Wishart and Luttrell, driving another Mercer, dropped out Wishart at 200 miles after having broken a left front spring twice; and Luttrell through burning out a motor bearing, due to not having a vent hole in a new filler cap on the oil tank, the result being that the oil pump became air-bound and failed to work.

Ralph Mulford driving a Mason gave promise of being one of the leading contenders and held second or first place until 80 miles, but was forced out by stripping the bolts securing the flywheel to the crankshaft flange. H. Endicott in an Endicott special dropped out through exhaustion at 235 miles after having run in third place for 120 miles, his withdrawal putting Chandler Mason into third money.

Had Rickenbacher kept his Mason in the running the interest in the race would doubtless have been much increased, although the duel between De Palma and Dawson kept interest high until the finish. Rickenbacher started off to set the pace, establishing the class record of 7 in the second lap and jumping from fourth position into first place. Here he held for four laps with Mulford his team mate but seconds back of him in second position and De Palma and Dawson see-sawing for third and fourth positions. This struggle for position continued until 100 miles were covered when the drivers had settled into positions which continued practically unchanged until the end of the race, with the exception of those that moved up due to the elimination of others. At this point De Palma had 4 minutes on Dawson but the bulldog tenacity of the latter showed itself to great advantage so that by 180 miles he had cut the margin to 2 minutes. But this was the closest he reached, and from here to the end De Palma gradually widened the gap, driving at all times a careful race.

Rest of Field Far Behind

The remainder of the field was far behind. At 200 miles De Palma was 40 minutes ahead of Endicott who was running third and nearly 50 minutes ahead of Chandler's Mason which was given third place. Rickenbacher in another Mason, having been delayed by valve trouble, was over 80 minutes back, plugging along without hope of catching the leaders.

Line-up of the drivers before the start of the race for the Chicago Automobile Club trophy at Elgin on Friday

OF 450 INCHES DISPLACEMENT AND UNDER, HELD AT THE FOURTH ANNUAL ELGIN ROAD RACES, AUGUST 29-30

15 125 Miles 4050 Ft.	16 134 Miles 800 Ft.	17 142 Miles 2830 Ft.	18 150 Miles 4860 Ft.	19 159 Miles 1610 Ft.	20 167 Miles 3640 Ft.	21 176 Miles 390 Ft.	22 184 Miles 2420 Ft.	23 192 Miles 4450 Ft.	24 201 Miles 1200 Ft.	25 209 Miles 3230 Ft.	26 217 Miles 5260 Ft.	27 226 Miles 2010 Ft.	28 234 Miles 4040 Ft.	29 243 Miles 790 Ft.	30 251 Miles 2820 Ft.	31 259 Miles 4850 Ft.	32 268 Miles 1600 Ft.	33 276 Miles 3630 Ft.	34 285 Miles 380 Ft.	35 293 Miles 2410 Ft.	36 301 Miles 4440 Ft.
10	9	10	10	9	8	8	8	8	9	9	9	9	9	9	9	8	Running				
2	2	3	2	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
3	3	2	3	2	2	3	3	3	4	4	4	4	4	4	4	4	3	3	3	3	3
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
9	9	10	9	9	9	9	8	8	8	8	8	8	8	8	8	7	6	6	6	6 Running	
6	7	6	6	4	4	4	4	4	3	3	6	7	7	7	7	Out					
4	5	5	4	6	Out																
7	6	7	7	5	6	6	6	6	6	6	5	5	5	5	6	6	5	5	5	5	5
8	8	8	8	8	7	7	7	7	7	7	7	6	6	6	5	5	4	4	4	4	4
5	4	4	5	7	5	5	5	5	5	5	3	3	3	3	3	3	Out				

Mulford Drives His Mason Entire Distance Without Tire Change

(*Continued from page 409*)

troubles, and Bergdoll was in third place and making a bid for second when his fuel gave out. His first stop was in the first lap when he put in a new plug and taped one of the petcocks. He ran 142 miles and then stopped for water and oil, and also tightened up the throttle lever connection. He lost 3 minutes and 22 seconds altogether in his two stops.

Endicott's Case halted only twice during the thirty laps he made before he was flagged. The first one, however, was lengthy and held him at the pit for 18 minutes while he changed the breaker box on the magneto. At the same time he replaced a left rear tire and filled up his supply tanks. The only other stop was in the twenty-fifth lap when he changed the left front tire, being delayed 1 minute and 15 seconds.

Burman's 162 miles accomplished in the Keeton before the car went out with a cracked cylinder occasioned him only one stop. This was after he had run 160 miles when he halted for fresh supplies of gasoline and oil.

Henning Broke Oil Pump

During the 35 miles covered by Henning's Velie two stops were made and both times the radiator was refilled. The first stop was occasioned by the air valve sticking in the carbureter so Henning removed the air valve entirely. He had a hand pump to force auxiliary oil into the motor, but it failed to work and a new one was put on. This was done so hurriedly, however, that it broke within a short time and was the ultimate cause of his withdrawal from insufficient lubrication.

De Palma's Record of Fewest Stops at Pits a Factor in Victory

(*Continued from page 411*)

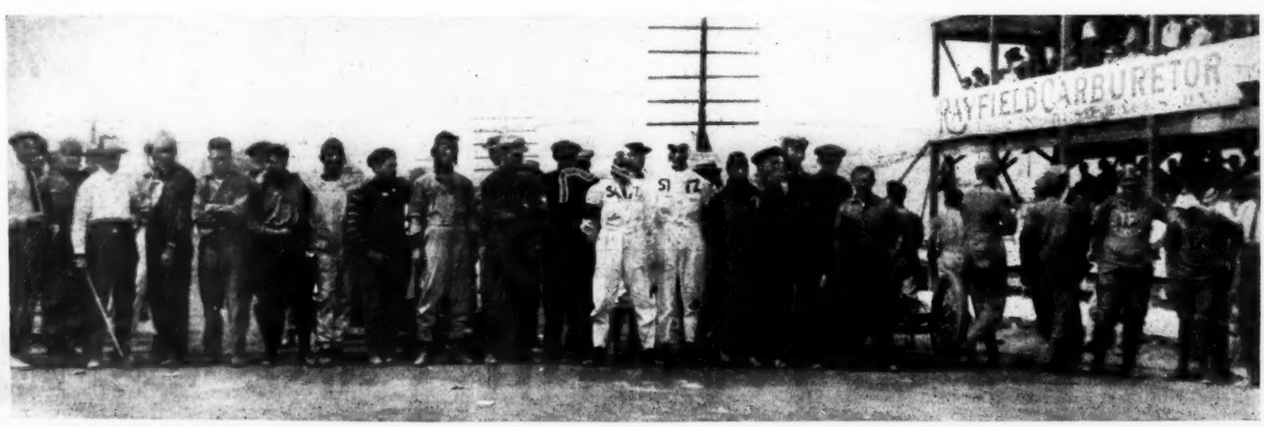
was taken at the same time to tighten up the shock-absorbers. This occurred in the twenty-seventh lap and held Dawson for 2 minutes and 11 seconds. Dawson took on no oil at any time during the event and used only 3.25 gallons.

Rickenbacher, who was running in fifth position when flagged, holds the distinction of being the only driver to finish the small race without a tire change, although he made the fastest lap of the day. Two of the four stops of the Mason were due to sticking valves. Nearly 5 minutes were lost at the end of the ninth lap when one of the valves was replaced and oil and water taken on. Rickenbacher stopped again in the next lap for 1 1-2 minutes and looked at the valves but did not work on them. In the eighteenth lap he pulled up at the pit and poured nearly a gallon of gasoline into the oil tank because he thought the oil he was using was too thick. His next and last stop was at the end of the twenty-second lap and held him up for over 2 minutes while he cut down the gasoline feed in the carbureter.

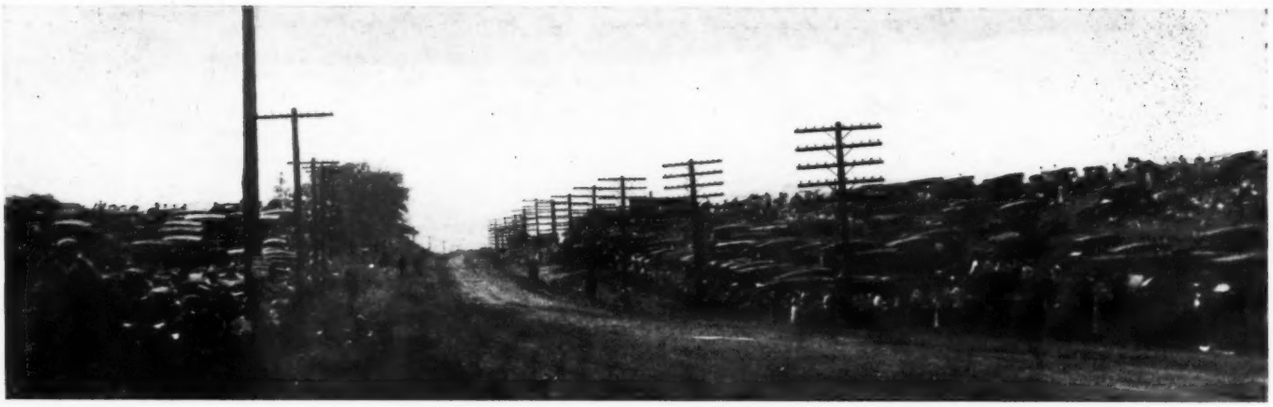
Harry Endicott, in the Endicott Special, changed only two tires before he dropped out in the thirtieth lap on account of illness. He made four stops altogether, the first one for tire change, the second for a tire change, the third for a change of mechanics, and the fourth for oil.

Luttrell in a Mercer made only two stops before he went out in the fifteenth lap. His first one was to repair a leaky water pump and the second to change spark-plugs.

During the 95 miles that Mulford's Mason was in the race, he made no stop and was running in fine shape when he went out.



Participants in the Elgin National trophy contest at Elgin Saturday, grouped at the starting line before the race



View of the homestretch on the Elgin course, showing how thickly the spectators and cars lined the fences

Deltal, Isotta and Erwin Special Are Novel Racers

Bill Endicott's Case Only Six-Cylinder Car to Compete at Elgin

ONE of the most interesting cars, from a mechanical viewpoint, which rounded the course at Elgin in the first day's race, was the Deltal, driven by Joe Dawson. This car was built in a small town in Connecticut by two men, Messrs. Delling and Hacketal, from a combination of whose names the car gets its name. Many of the parts of the car were bought from manufacturers and a number were made by Mr. Delling.

Simplicity is the feature of this car and this is well brought out in the motor construction. The cylinders are of the L-head type cast in block with the valves on the right side. A glance at the motor shows nothing but eight wires leading to the spark plugs and the bare cylinders. The magneto and water pump are hardly visible, being driven by a transverse shaft in the front of the motor.

The oil is carried in tank of 5 gallons capacity and for the Elgin race was fed under 40 pounds pressure. Even with this high pressure the car showed little smoke of the exhaust. The gasoline tank was filled and measured 26 gallons. Only one filling was made during the race and at the end there was at least 5 gallons in the tank.

Another important mechanical construction in the Deltal is the clutch, which is of the cone type running in oil, much against the present common practice of dry running. In a test before the race the motor showed 3,250 revolutions per minute and the drop in the power curve had not yet been reached. The designer stated that at least 4,000 would show without a drop, were the throttle opened wide. At the speed attained by the test, the dynamometer showed 122 horsepower.

The extra wheels and tires of the Deltal were carried on a dummy axle running across the floorboards and under the cowl. One wheel was fastened at either end. Although seemingly impossible, the brakes of the Deltal are adjustable from the driver's seat, a very desirable feature on racing cars considering that the failure of the braking system has caused many cars to climb trees. It cost the owners close to $11,000 to place the Deltal on the track at Elgin.

Another car which is of unique construction is the Isotta, which was driven by Harry Grant. It was the only chain-driven car in the race of either day and its most important feature is the braking system. There are two sets of brakes, one set acting on the front wheels and the other on the rear wheels. The former set are operative with a lever similar to the emergency brake lever of most cars. The rear wheel brakes are controlled by the conventional pedal. The driver in taking turns could do this

SPECIFICATIONS AND EQUIPMENT OF CARS PARTICIPATING IN THE FIRST DAY'S RACE AT ELGIN

No.	Car	Driver	Bore	Stroke	Disp.	No. Cyl.	Magneto	System	Carburetter	Size	VALVE Size	VALVE Lift	Wh'l-base	Gear Ratio	W'ght	Oil	Wire Wh'ls	TIRES FRONT Make	FRONT Size	REAR Make	REAR Size
20	Deltal	Dawson	4	5.945	298.95	4	Bosch	Doub. Scheb.		2	2 1/16	1/2	109	2.6–1	2,300	Polarine	R.-W.	Diamond	34x4½	Diamond	34x4½
21	Mercer	DePalma	4.37	5.00	299.93	4	Bosch	Doub. Rayf.		2	2 1/8	7/16	108	2.5–1	2,400	Monog'm	R.-W.	Firestone	32x4	Pro'dnik	32x4
22	Mason	Rick'b'cher	3.985	6.0	299.33	4	Split.	Doub. Scheb.		1 7/8	2 5/16	7/16	106	2.25–1	2,000	Monog'm	R.-W.	Michelin	32x4	Michelin	34x5
23	Mercer	Wishart	4.37	5.0	299.93	4	Bosch	Doub. Rayf.		2	2 1/8	7/16	108	2.65–1	2,400	Monog'm	R.-W.	Michelin	32x4	Michelin	32x4½
24	Mason	Chandler	3.819	5.0	229.02	4	Split.	Doub. Scheb.		1½	1 13/16	7/16	104	2.6–1	1,875	Texaco	No	Michelin	32x4	Michelin	32x4
25	Nyberg	H.Endicott	3.75	5.0	220.9	4	Split.	Doub. Scheb.		1¼	.....		100	2.66–1	1,700	Polarine	Frayer	Goodyear	32x4	Michelin	32x4
26	Mason	Mulford	3.985	6.0	299.33	4	Bosch	Doub. Rayf.		1 7/8	2 5/16	7/16	106	2.25–1	2,000	Oilzum	No	Braender	32x4	Braender	35x5
27	Mercer	Luttrell	4.376	5.0	300.78	4	Bosch	Doub. Rayf.		1 7/8	2 1/8	7/16	108	2.5–1	2,350	Monog'm	No	Shawmut	32x4	Shawmut	32x4

SPECIFICATIONS AND EQUIPMENT OF CARS PARTICIPATING IN THE SECOND DAY'S RACE AT ELGIN

No.	Car	Driver	Bore	Stroke	Displ.	No Cyl.	Magneto	System	Carburetter	Size	VALVES Size	VALVES Lift	Gear Ratio	W'ght	Oil	Wire Wh'ls	Wh'l-base	TIRES FRONT Make	FRONT Size	REAR Make	REAR Size
1	Case	W.Endicott	4.367	5.0	449.31	6	Bosch	Doub. Rayf.		2	2 1/16*	.....	2.25–1	2,280	Texaco	No	108	Michelin	32x4	Michelin	35x5½
2	Mason	Rickenb'h'r	4.315	6.0	350.91	4	Split.	Doub. Scheb.		1 3/4	2 5/16	7/16	2.25–1	2,100	Monog'm	R.W.	106	Michelin	32x4	Michelin	35x5
3	Mason	Mulford	3.985	6.0	299.33	4	Bosch	Doub. Rayf.		1 7/8	2 1/16	7/16	2.25–1	2,000	Oilzum	No	106	Braender	32x4	Braender	35x5
4	Mercer	Wishart	3.819	6.819	446.14	4	Bosch	Doub. Rayf.		2 1/4	3 1/4	7/16	2.25–1	2,700	Castor	No	112	Firestone	34x4½	Firestone	34x5
5	Stutz	Anderson	4.816	6.000	437.21	4	Bosch	Doub. Scheb.		1 3/4	2 1/2	7/16	2.25–1	2,300	Texaco	No	112	Firestone	34x4½	Braender	34x4½
6	Marmon	Dawson	4.5	7.0	445.3	4	Bosch	Doub. Scheb.		2	2 1/4	1/2	2.00–1	3,000	.....	No	120	Firestone	34x4	Firestone	35x5
7	Mason	Haupt	4.315	6.0	350.912	4	Bosch	Doub. Scheb.		2	2 1/16	7/16	2.25–1	2,000	Oilzum	No	106	Michelin	32x4	Michelin	34x5
8	Keeton	Burman	5.5	5.5	449.417	4	Bosch	Doub. Rayf.		2½	.....		2.00–1	2,349	Polarine	Yes	108	Therm'd	33x4½	Therm'd	34x4½
12	Velie	Henning	4.5	5.25	334.00	4	Split.	Sing. Scheb.		.....	.....		2.60–1	.....	Havoline	No	110	Michelin	34x4	Michelin	34x4
14	Mercer	DePalma	4.819	6.819	446.14	4	Bosch	Doub. Rayf.		2 1/4	3 1/4	7/16	2.25–1	2,600	Monog'm	R.W.	112	Firestone	32x4	Firestone	34x5
15	Isotta	Grant	4.72	6.30	440.75	4	Bosch	Doub. Zenith		2	2	1/2	2.63–1	2,700	Monog'm	Riley	110	Palmer	34x4½	Palmer	34x4½
16	Erwin	Bergdoll	4.535	6.945	448.22	4	Bosch	Doub. Rayf.		2	2 1/4**	1/2	1.75–1	2,850	.....	No	108	Braender	34x4	Braender	34x4½

*Exhaust given; Intake two to each cylinder 1 1/8 diameter.
**Exhaust 2 3/4 inches diamteer.

TABLE SHOWING POSITIONS OF CONTESTANTS LAP BY LAP IN THE FIRST DAY'S RACE AT ELGIN

No.	Driver	Car	Laps	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	Time	Aver.
20	DAWSON	Deltal		2	4	3	4	4	4	3	4	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	279:52:75	65.2
21	DEPALMA	Mercer		3	3	4	3	3	3	4	3	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	271:56:90	66.8
22	RICKENBACHER	Mason		4	1	1	1	1	1	2	2	7	7	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5	5	5	5	Retired from race									
23	WISHART	Mercer		5	8	8	7	7	5	5	5	4	4	3	3	3	3	3	5	5	5	5	5	5	5	5	5	Broken spring; out													
24	CHANDLER	Mason		6	5	5	5	6	7	6	6	6	6	5	5	5	5	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	Third place when race was stopped						
25	ENDICOTT	Nyberg		8	7	7	8	8	8	7	7	5	5	4	4	4	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	Water pipe broke; out						
26	MULFORD	Mason		1	2	2	2	2	2	1	1	1	1	Sheared flywheel bolts; out																												
27	LUTTRELL	Mercer		7	6	6	6	5	6	8	8	8	8	7	7	7	7	Burned connecting-rod bearings; out																								

much faster than the majority of the cars on the track. About 200 yards before the turn was reached both sets of brakes were applied and then as the front wheels hit the turn the front wheel brakes were released and the rear only used, as ordinarily.

The motor of the Isotta is a block casting with the valves in the head, the mechanism being inclosed by a plate which has four breathers for cooling the valve mechanism. Grant carried 43 gallons of gasoline and 12 gallons of oil. The pistons of the Isotta are dome shaped, the distance from the top of the dome to the contact surface at the side being about 2¼ inches. Two, wide, so-called, leak proof rings are used and five oil grooves. The connecting rods are hollow and made of steel. The car is of 110-inch wheelbase and has right drive and right gearshift control.

Erwin Motor Has Light Pistons

Another characteristic car was the Erwin special driven by Bergdoll. This car was equipped with a Benz motor, the cylinders of which are cast in pairs. The valves are all in the head and removable with the cage. The inlet valves are of 2⅞ inch diameter and the exhaust 2¾ inches, both having a lift of 5/8-inch. The pistons are of magnalium, a metal which is said to have very good wearing qualities and be of very light weight. Indeed a piston of the Erwin motor compared favorably in weight with an ordinary hat. The material is made of a combination of magnesium and aluminum primarily and the coefficient of expansion very nearly that of gray iron.

The Erwin is of 108 inches wheelbase and weighs 2,850 pounds. The gear ratio, 1¾ to 1, was the lowest used in either day's racing at Elgin. The driver carried between 45 and 50 gallons of gasoline and 11 gallons of oil.

Another car which used magnalium pistons is the Mason, driven by Rickenbacher. The only change made for the second day's race was the substitution of larger cylinders, pistons and rods, but the material of all was the same in both cases. Rickenbacher's car is of 106 inches wheelbase with left drive and center control. It is of characteristic motor construction, the valves being in the head.

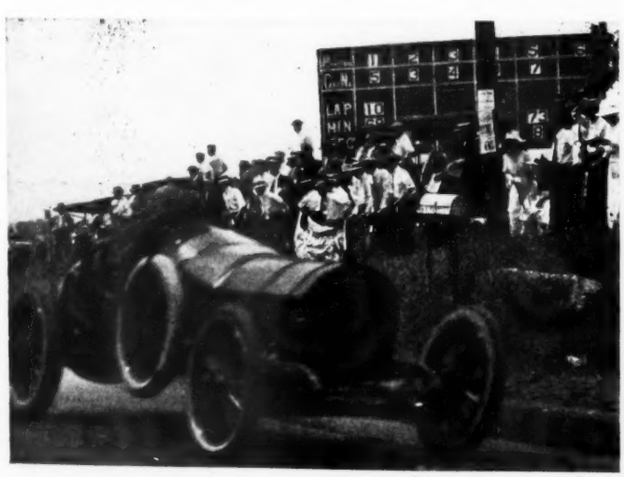
The Mercers entered in both day's races are very much the same mechanically. The motors all are of four-cylinders of T-head construction with the cylinders cast in pairs. De Palma's first mount has a 108-inch wheelbase and the second day 112. The same is true of Wishart's car. In fact these two men drove practically the same car each day. All the Mercers have right drive, right gearshift control, and a disk clutch. On the first day at Elgin De Palma's car had a 2¾-inch valves with 7-16-inch lift and on the second day 3¼-inch valves with the same lift. Wishart's cars had the same dimensions for both days. On the first day De Palma carried 40 gallons of gasoline and 15 of oil and on the second day 25 gallons of gasoline and 5 of oil. Wishart had a 30-gallon gasoline tank on the first day and carried 15 gallons of oil and on the second day the tanks were the same as De Palma's.

Bill Endicott's Case car was the only six cylinder car in either day's event. The motor has its cylinders cast in pairs with two intake valves to each cylinder. These valves are 1⅝-inch in diameter. The exhaust valves are 2⅞ inches diameter. Endicott's steed has a 108-inch wheelbase and left drive and center control. He carried 25 gallons of gasoline and 20 gallons of oil.

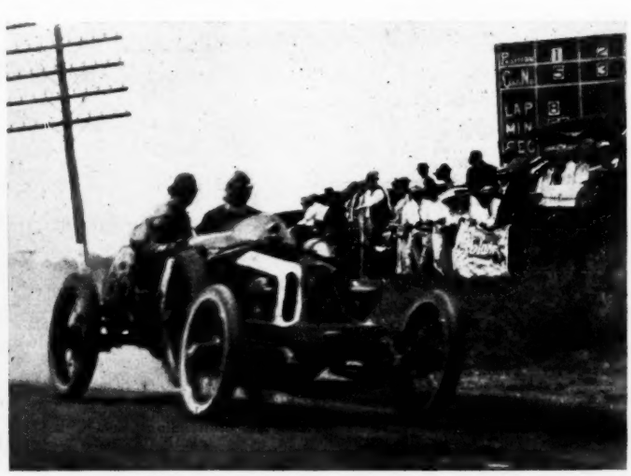
Anderson's winning Stutz has a four-cylinder motor of T-head construction, cast in pairs. The valves on opposite sides are 2½ inches in diameter and have a lift of 7-16 inch. The drive from the motor is through a cone clutch to a gearset located a unit with the rear axle, which is characteristic Stutz construction. The Stutz has a 112-inch wheelbase and right drive and right gearshift control. Anderson carried 30 gallons of gasoline and 10 gallons of oil.

All Mason Motors The Same

All the Masons have Dusenberg motors of the same type, the cylinders being cast in block and the valves in the head. All have 106-inch wheelbase except Chandler's which has 104. In many other respects the cars are the same, driving from the motor by shaft to a cone clutch and then to a three-speed selective gearset. Rickenbacher was the only Mason entry to use wire wheels. He used them both days. Chandler's Mason which took third place in the first day's race had valves of 1 13-16-inch diameter and 5-16 inch lift. All the other Masons have 2 3-16-inch valves and 5-16-inch lift.



Joe Dawson in the Deltal at high speed



Burman getting the most out of his Keeton

Defend Electric Lighting Systems for Cars

Representatives of Companies Manufacturing Electric Lighting Devices and Readers Experienced in the Use of Both Electric and Acetylene Systems Protest Against Prest-O-Lite Tests

THE communication from R. H. Coombs regarding results of tests conducted by the Prest-O-Lite Company, Indianapolis, Ind., sometime ago, which was published in THE AUTOMOBILE for July 31, has brought forth several protests from manufacturers of electrical systems as well as from a number of our readers who have had experience with various types of lighting devices. These communications are published herewith. The main point of objection seems to be the contention of Mr. Coombs that electric apparatus is more expensive to operate than the acetylene, Mr. Rushmore, of the Rushmore Dynamo Works, stating that the acetylene system is more expensive in the long run even without taking into consideration the advantages of the electric system. The protests on the subject are as follows:

Prest-O-Lite Tests a Perfect Farce—Rushmore

PLAINFIELD, N. J.—Editor AUTOMOBILE:—It is a simple matter to determine the efficiency of a motor, as the power may be easily determined by a simple brake, but it is much more difficult, particularly with very small machines, to determine the true power input of a dynamo.

I consider the Prest-O-Lite Co.'s tests a perfect farce, for **the power consumption of even the least efficient dynamo is too small to noticeably affect the performance of the car as a whole,** in fact, to the engineer the results published by the Prest-O-Lite Co. are absolutely absurd, and if they have a competent engineer in their employ the results they give can hardly have been offered in good faith.

The working efficiencies of very small, variable-speed dynamos must be comparatively low at best. We have never been able to spare the time to determine the actual working efficiency of our dynamo, but we believe it is in the neighborhood of 60 per cent. at normal car speeds before the ballast coil becomes appreciably heated, while at the very highest speeds, when the field is bucked down almost to zero, we believe the efficiency may fall to as low as 30 per cent. if we include all the losses in ballast and bucking coils.

A Laboratory Test Would Have Been Better

The average car owner would probably consider 30 per cent. as a frightfully poor efficiency, but just have a look at the widely-advertised slipping clutch machine, of which we inclose performance curves, made by a well-known laboratory and said to be practically correct. The dynamo tested is of the geared type, with the armature turning at twice the speeds given, that is to say, the maximum armature speed is 4,800 revolutions per minute. The losses include the two-to-one gears, internal bearings, fan, etc., which are essential to the operation of the machine. In short, the speeds given are one and one-half times crankshaft speed, the armature running three to one; **thus at normal speed of 800 engine revolutions per minute the dynamo absorbed 280 watts when its efficiency was about 13 per cent. At maximum speed the power received from the engine rose to 550 watts, while the output was but 45 watts, or a net efficiency of but 8.25 per cent. In fact, the machine threw away in heat nearly .75 horsepower.**

This is about the worst case imaginable, and it would have been much better for the Presto-O-Lite Co. to have removed the dynamos from the cars for a laboratory test and stated honestly the actual power consumption.

Most cars carry two 15-candlepower headlights, two 4-candlepower side lamps and 2-candlepower lamps in tail and dash lamps, or a total of 42 candlepower, which, at 1.5 watts per candle, call for about 55 watts. Assuming an average of 12 watts additional for battery losses, the dynamo will be called upon to supply an average of, say, 65 watts when the lights are burning. Assuming a dynamo efficiency of but 40 per cent., this amounts to but 162 mechanical watts or but .22 horsepower.

This small amount of power does not noticeably affect the ability of the car, so our chief concern is the increase in fuel consumption. In the average service the automobile engine probably consumes about .2 gallon of gasoline per horsepower-hour actually developed, so that the operation of the dynamo increases the fuel consumption by but .044 gallon per hour, which, at 25 cents per gallon, amounts to 1.1 cents per hour.

At set of six tungsten bulbs costs the owners about $3. Allowing the bulbs an average life of but 300 hours, we must add another cent for lamp renewals. The battery costs $20 and will last about 2 years, so we may allow for battery, wear and tear on dynamo, etc., another cent per hour and have **a total maintenance and operating cost of about 3.1 cents per hour for the lighting system as a whole.**

Acetylene Can Be Used Only for Headlights

Acetylene cannot be used conveniently except for the headlights alone, but, assuming it to take the place also of the side, dash and tail lamps, the total consumption per hour in actual practice with all lamps burning cannot be less than 3 feet per hour. The charge for refilling the average Presto tank with 30 feet of gas is $2, which works out to a cost of 2 cents per hour with all lamps burning, and adding all incidental expenses of frequent renewal of rubber hose connections, burners, etc., the gas system cannot cost less than 2.5 cents per hour, so we may allow a saving of .6 cent per hour over the net average cost of electric lights. In practice, however, due to the time lost and extra mileage necessary to secure the frequent tank renewals, it will be found that **the acetylene system is really the more expensive in the long run without taking into consideration the great convenience and many advantages of the electric system.**

As practically all cars are now equipped with electric starters, the lighting system should be charged with the actual increase in fuel consumption and lamp renewals, or about 2 cents per hour, so that, all things considered, the Prest-O-Lite argument falls pretty flat.—S. W. RUSHMORE, Rushmore Dynamo Works.

Electric Lighting Satisfactory Since 1907—Gorton

SUMMIT, N. J.—Editor THE AUTOMOBILE:—I, too, am one of those who have been interested in the late advertising literature of the Prest-O-Lite Co. Some of their statements are misleading, and your letter from J. K. Mercer, in THE AUTOMOBILE for August 21, is along the right line.

My first experience with electric car lighting was back in 1907, when I electrically lighted my Franklin car throughout. I had

the Apple system, which at that time was very imperfect, owing to the fact that the device for controlling voltage did not always work, with the result that the bulbs did not last long. **At this time my car with its complete lighting equipment was a curiosity, and it was rare, indeed, to meet another car so lighted. The superiority of the light, however, over acetylene was such that when I sold this car and purchased a new one, gas lighted, I succeeded in purchasing the old lighting system later from the man to whom I sold my car, and again had it installed, as I found the difference in lighting to be about the same as the difference between kerosene and acetylene.**

Never Had Trouble With Electric System

At the present time I am driving a car 2 years old, which I had completely lighted with the Gray & Davis system. During these two years I have never had one moment's trouble with the lighting system on the car. Every 2 or 3 months I have added water to the storage battery, and, so far as I know, it is as good to-day as it was 2 years ago. The little generator has been oiled but once in these 2 years, and, with the exception of occasionally tightening the belt, I would not know that it was on the car. It is absolutely noiseless and apparently a perfect generator. The lights are steady and brilliant, and in the 2 years I have burned out but two bulbs, and I believe them to have been defective. **The system is so perfect and the light so excellent that nothing would induce me to be without it.**

If it takes more gasoline to run the generator, I am not aware of it, as I am getting more miles to the gallon than most of my friends with the same style of car. I have always had ample light, the cost of which for 2 years has been two burned-out bulbs. Even if it had cost considerable, I would be more than satisfied, as its convenience would more than offset it.

Electric lighting of automobiles has come to stay, and from a pioneer, going months without meeting another car electrically lighted, up to to-day, when every other car is so lighted, the change has been wonderful and to me especially gratifying, because it was my prediction.

I might add that my ignition is Bosch dual with 6-volt 80-ampere lighting battery used for starting.—Dr. Eliot Gorton.

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Increase in Weight Only Slight—Kebler

Bronxville, N. Y.—Editor The Automobile:—I note in The Automobile for July 31 that R. H. Coombs of the Prest-O-Lite Co. advances arguments concerning the power necessary to rend charging dynamo for electric lights. No one ever expected that power could be produced from a dynamo without putting power into it. **Actual tests on the stock dynamo of one of the large concerns with a constant current output of 10 amperes into a battery, shows that at all normal engine speeds the power necessary to drive the dynamo averages about .21 horsepower.**

In his dissertation Mr. Coombs says: "The result of these tests shows that from 5 to 12 per cent. of the fuel fed into the gasoline engine of an electric lighted car is consumed by the electrical apparatus."

Let us analyze Mr. Coombs' figures. If a car were driven 6,000 miles in the course of a year at an average of 16.5 miles per gallon, as in Case 2, the gasoline cost (at 18 cents per gallon) will be 65.52 for the year. Now, if 7.8 per cent. of the amount of gasoline used, is used by the electric dynamo, as per Mr. Coombs' figures, this will mean a total gasoline cost for light of 5.11, which is undoubtedly decidedly less than the cost of lighting a car by means of gas and oil during that period.

Another statement that is rather interesting is: "The discharge rate for two average headlights and one tail light is between 9 and 11 amperes." The average headlight has a 16-candlepower bulb and takes less than 3 amperes. The average rear light has a 2-candlepower bulb and takes less than .5 ampere.

The average pair of 16-candlepower headlights and 2-candlepower tail lights will take about 5 amperes, and even if the customer uses 21-candlepower headlights (the largest used in ordinary practice) he would not get anywhere near the 9 amperes discharge rate mentioned.

Mr. Coombs further states: "The dynamo must generate close to 14 amperes if the battery is to be charged at all for the owner who does his driving by night and little by day."

This statement is just as incorrect as the former ones, and a charging rate of 10 amperes is ample for any owner who has 21-candlepower headlights and 2-candlepower or 4-candlepower rear light, and drives all the time at night.

The statement that "Some of the cars of the Indiana-Pacific Tour have had to burn their lights a few hours each day in the daytime to keep from overcharging the battery" is incorrect, and if any drivers did it they did it through ignorance.

Another statement is: "Storage batteries used for both starting and lighting are having an average life of less than 1 year. Batteries used for lighting alone are having an average life of considerably less than 2 years."

My experience in the electric lighting and starting field has been rather extensive and dates back to the beginning of this development. **Practically all batteries that have been on cars with lighting systems under my observation in the last 3 or 4 years are still in use without giving any trouble whatsoever. Batteries in use for over a year are universally giving perfect satisfaction, with no signs of when their useful life will cease.**

I am interested in the statement: "It must be remembered that when a motor car maker adds 200 pounds of electrical equipment, etc.," because this is another exaggeration similar in its type to those already mentioned.

One system such as is used by cars having an engine the size of some of those mentioned by Mr. Coombs in his article, will weigh a total of about 130 pounds or less, including the weight of the wires, cables, switches, dynamo, motor, battery, gears, etc. Subtract from this the weight of the usual storage ignition battery, which weighs between 30 and 40 pounds, and the weight of the Type B Prest-O-Lite tank, which weighs some 25 pounds, plus the weight of the heavier lamps necessary if gas and oil are used, and you will find that the motor car maker is adding to the weight of his car very little indeed.—Leonard Kebler, President Ward Leonard Electric Co.

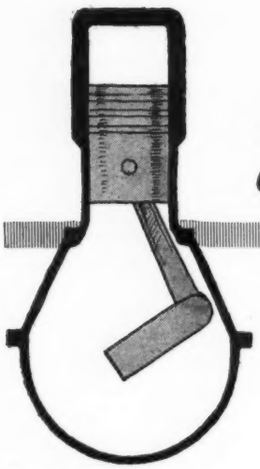
—

Both Systems Have Their Advantages—Macksey

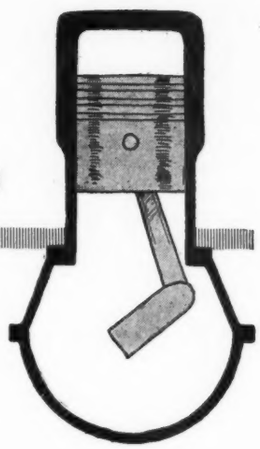
East Orange, N. J.—Editor The Automobile:—I have been following your very interesting articles on the up-keep of electric lighting and acetylene systems. For the last 3 years I have been using the Prest-O-Lite tank and have found it satisfactory. But I think that the electric lighting systems also have their good qualities, both in convenience and efficiency. I don't believe that the extra weight of the electric equipment will count much on a high-powered car. When it comes to figuring on the gasoline consumed, I don't believe that it will make any material difference, as a great deal is unnecessarily used when a car is standing still at the curb, etc.

I believe the time is nigh when the automobile concerns will all include electric lighting systems as standardized equipment. Though they may cost more, they are what the automobile users want, as the development of the horseless vehicle has ever been toward convenience. The automobilists of today want both service and simplicity. They want to start at a minute's notice, avoiding all unnecessary work and risk. Looking back a decade or so will bring out the point most desired. An automobilist of those days went to a tremendous amount of trouble when he started out for a run. He didn't have self-starters, lighting systems, quick-detachable tires. Compare those days with the present time and the miraculous development is obvious.

I want to see more of these articles. They are sure to bring out facts that will materially help your readers.—J. F. Macksey.



Most Efficient Stroke-Bore Ratio



Medium-Long-Stroke Motor Easier on Crankshaft and Connecting-Rod Bearings Than the Short-Stroke Type of Engine

By E. P. Batzell—Part V

¶ This is the last of a series of articles which without doubt go more deeply into the subject of the long-stroke motor than any previously published discussion. Mr. Batzell has taken up one by one the different parts of the motor which are affected by changes in the stroke bore ratio and has pointed out the good and bad results of long, short and medium-stroke motors on each of these parts. Appended to this concluding part is a complete mathematical proof of the various points taken for granted during the semi-technical explanation in the main body of the story. Engineering readers who are interested in the discussion will find here a clear explanation of the hypotheses assumed by Mr. Batzell.

FOR instance, the determined smaller heat loss in the cooling jacket of the medium-stroke motor would permit to reduce the requirements imposed on the whole motor cooling system. Although the difference in the heat losses is not great, amounting to a few percents of the losses in the short-stroke motor, but the range of the influence of that much less losses could be judged more properly, when remembering that the reduction or increase of the radiator cooling surface in the neighborhood of five per cent. makes quite a noticeable difference in the rate of the motor cooling. Of course the manner of the individual drivers, their ability of controlling the spark and the running of the motor, also the internal condition of the motor itself—whether carbonised or not, adequately lubricated or not, etc., might reveal a much greater variety in the rate of motor heating than would be obtained by the difference in the heat losses of 5 per cent. Nevertheless, in the case of an equally set comparison, there remains no doubt, that the medium long stroke motor will have a point of advantage over the extreme stroke-to-bore ratios also in respect of the easier cooling afforded with its use. The capacity of the cooling system might be reduced; also its water circulation and therefore the loss of power for the driving of the circulating pump, if there is one.

High Piston Speed Effects

As a general rule, the medium-long-stroke motor can be easily constructed to afford a lower specific pressure upon its crankshaft and connecting-rod bearings, than would be obtainable with the short-stroke type.

This is particularly valuable for the modern high-speed motor, when the operative piston speed reaches 2,000 and more feet per minute, at crankshaft revolutions per minute as high as 2,000 and well above that figure. The lower specific pressure reduces the chances for burning out the bearings due to inadequate lubrication. This fact can be considered as an important item in connection with the life of the motor. Moreover, the constructive execution of the long-stroke motor permits to incorporate without difficulty proper sizes for those parts of the valve mechanism which as generally limited to their desirable length by the space available in the given motor height. The longer valve guides, tappets and springs give an added security in freedom from trouble in those parts during the functioning of the motor. More frequently the greater length of space will take care properly of these parts so proportioned, as to be suitable for the valve mechanism with a higher valve lift, without impairing the actual reliability of the motor from this source due to the extra work imposed on the parts by the greater valve lift.

Influence on Total Weight

A very interesting question, which as yet however, remains without being answered positively in favor of the long or short-stroke motor types, is the influence of the stroke-to-bore ratio upon the total weight of the engine.

One is inclined to believe that the shorter-stroke motor remains superior in this respect, but there is no doubt that one can build very light motors of either type. There is not much difficulty connected with the building of light long-stroke motors, as can be proven by their increasing gain of popularity in the aeronautical field, and at the same time the heavy short-stroke motors are still a more or less common occurence. The ability of the designer to select the most advantageous and at the same time the lightest shapes for the distribution of the metal under stress has paramount value in the matter of motor weight.

Parallel with the total motor weight one can consider as being unsolved the question of weight of the reciprocating motor parts, which would indicate the ability of the different motors to reach higher piston speed without harmful vibration. The latest practice in the construction and dimensioning of these reciprocating parts however tends to indicate that the short-stroke motor is more apt to become the loser in this respect. With the elimination in these parts of all metal permissible from the standpoint of merely strength, extending this method even to the building of ordinary touring cars, whereas previously this was considered practical only for racing purposes, the question of weight enters into a phase favorable for the long-stroke motor. Under equal condition their lightened parts will render possible a higher speed of the motor, keeping it almost vibrationless in steady running. It will be remembered that the general proportioning of the vital load carrying parts in the long-stroke motor is such that it does not raise any objections to an increase of its speed. On the other hand it appears that during the periods of acceleration the vibration created by the change in the inertia of the moving parts causes effects, which are

considerably more pronounced in the long-stroke motors.

Summarizing all what has been found for and against the long and short-stroke motors one could state, that there cannot possibly be found an economical reason for the building of short-stroke motors, or motors of the other extreme proportion. The medium-long-stroke motors are the most economical, the best performing and all around satisfactory type, which is well confirmed by the results obtained with them in practice, in the hands of expert drivers and average users as well. The determination of the most economical stroke-to-bore ratio is not a difficult problem, being merely a matter of a few quite simple calculations.

Long-Stroke Points Mathematically Proved—E. P. Batzell

In the first, the general part of these articles, it was stated, that the double ended cylinder of minimum wall surface per volume of content would have a length equal to its bore. This can be derived in the following manner, using the general rules of maxima and minima. Let the cylinder diameter be indicated by D, its whole length (including the combustion space when referring to engine cylinders)—by L and the ratio of L to D by R. The total wall surface in this double-ended cylinder is equal to $\frac{\pi D^2}{2} + \pi DL$ and its volume $\frac{\pi D^2}{4} \times L$.

Therefore, the ratio of the wall surface to the volume can be expressed as

$$\frac{A}{V} = \frac{2\pi D^2 + 4\pi DL}{\pi D^2 L} = \frac{2D + 4L}{DL}$$

Introducing into the above the fraction L/R in place of D, one will obtain an equation reading:

$$(1) \qquad \frac{A}{V} = \frac{2L/R + 4L}{L/R \times L} = \frac{2 + 4R}{L}$$

By substituting of L/R in place of D in the equation for the cylinder volume $V = \frac{\pi D^2}{4} \times L$ one will arrive to the expressions $V = \frac{\pi L^3}{4R^2}$ or

$$(2) \qquad L = \sqrt[3]{\frac{4V \times R^2}{\pi}}$$

Introducing this value of L into the equation (1) it will change the latter to

$$\frac{A}{V} = \frac{2}{\sqrt[3]{4V/\pi \times R^2}} + \frac{4R}{\sqrt[3]{4V/\pi \times R^2}}$$

which in its turn can be changed further to the form

$$(3) \qquad \frac{A}{V} = \frac{2}{\sqrt[3]{4/\pi} \times \sqrt[3]{V} \times R^{2/3}} + \frac{4 \times R^{1/3}}{\sqrt[3]{4/\pi} \times \sqrt[3]{V}}$$

Inasmuch as the minimum amount of surface has to be determined in connection with a given volume, the value V in the above equation should be considered as a constant. Remembering the rules of maxima and minima, to find the value of R which will correspond to the cylinder of relatively minimum surface, in other words, when the expression for A/V reaches its minimum, one has to differentiate the latter by R. This will give

$$(4) \qquad \frac{d\frac{A}{V}}{dR} = \frac{4}{\sqrt[3]{\frac{4V}{\pi}}} (-1/2 \times 2/3\, R - 5/3 + 1/3\, R - 2/3)$$

The value of R which turns to zero the expression enclosed in the parenthesis will be that affording the minimum for the fraction A/V. Thus, $R - 5/3 = R - 2/3$ which is possible only when $R = 1$, proving that the relative minimum of cylinder surface is obtained in a cylinder with its length equal to its diameter.

The intensity of motor cylinder cooling, respectively the amount of heat units Q taken from the hot gases and carried away by the provided cylinder cooling jacket can be expressed by the formula

$$(5) \qquad Q = F\,(T - t) \times Z \times K$$

in which F is the cooled surface in contact with the gases, T — t is the temperature difference between the gases and the walls, Z — the time of contact duration between the gases and the walls, and K is a coefficient, a constant when the comparison is being drawn under certain equal conditions of surfaces, lubrication, etc. It will be noticed that the amount of heat losses in the motors is here made proportional to the heat absorbing capacity of the cylinder walls, not to the cooling capacity of the jacket directed towards absorbing the heat from the walls. That is done so because the amount of heat absorbed by the walls from the gases generally will be much less than the amount of heat which can be carried away from the walls by the jacket cooling medium. Consequently the limit of motor heat losses is set by the losses from gases to the walls, and not by the possible losses from the walls to the cooling jacket.

The value F is variable through the motor stroke, changing according to the piston position, exposing a greater or smaller part of the cylinder surface. The piston velocity being also a variable during the stroke, thereby enters a changeable element of time into the also simultaneously changing element of exposed gas cooling surface. Such a variation of the time and the surface together with the temperature difference make it a difficult mathematical problem to solve the equation (5) in this manner. The equation would have to be integrated by three variables, each of which enters as a transcendent function. However, it is a comparatively much simpler problem to obtain the desired results in a graphical way, accurate enough to permit a reliable comparison of the heat losses in the different motors. It is best to enter the curves of surface and temperature, represented in Fig. 7 of the first part, into a chart as functions of the time, because this would introduce into the comparison of the motors the factor of time as a constant, because it would have to be taken into account merely as a relative value, not actual. The correctness of the results is preserved regardless of the motor speed, provided all motors run equally fast. The rotation of the crankshafts being practically uniform, it affords the substitution of the factor of time by the elements of this rotation. There-

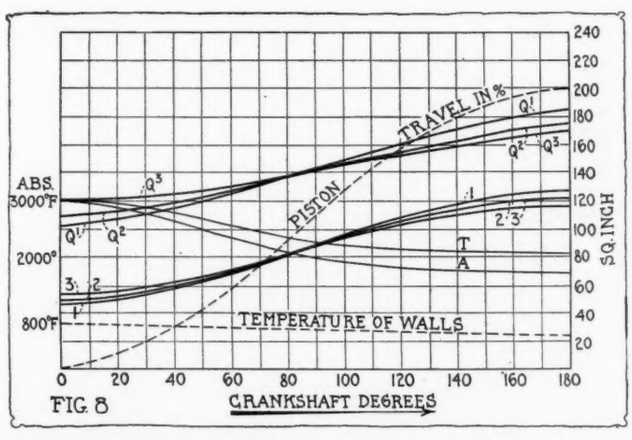


FIG. 8

Curves of cylinder surface and temperature referred to time

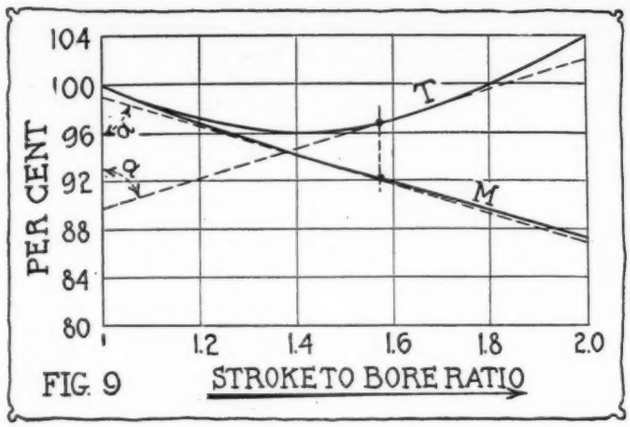


FIG. 9

Thermal losses plotted with different stroke-bore ratios

fore the curves of cylinder surface and temperature will be represented in a form characterizing the time factor, when they are drawn in relation to the crankshaft motion in degrees throughout a motor stroke. (See Fig. 8.) The surface curves are again indicated by letters as in Fig. 7, the symbol (1) referring to the motor size 3.57 x 7.14, symbol (2) the size 4 x 5¾, and the symbol (3) the size 4½ x 4½.

Comparative Heat Losses

The comparative values for the heat losses will be obtained by the multiplication of the surface amounts by the temperature differences at the same moment of crankshaft position, repeating this through the whole motor stroke. The products of this multiplication can be introduced into the same chart in a certain scale, thus giving the variation of a factor proportional to the actual momentary motor heat losses in respect to the crankshaft position. The total amount of the heat losses in the different motors will be proportional to the area enclosed between the two limiting ordinates, the horizontal co-ordinate axis and the curve connecting the momentary heat losses. That motor will have the greatest heat loss, which possesses the greatest area as calculated above. For calculation one should use the actual temperature difference between the gases and the walls, in other words, the difference between the curve of temperatures "T" and that for the cylinder walls, which can be assumed approximating 212 degrees F., slightly higher at the upper cylinder end than at the lower. As formerly stated, the accurate supervision of the curves and areas of the three motors reveals the superiority of the 4 x 5¾ inch size.

Mechanical Losses Proportional

The mechanical losses in the three motors are practically proportional to their crankshaft bearing diameters, and for the given piston displacement one can illustrate graphically the elapsing of these losses in respect to the selected stroke to bore ratio. Curve M in Fig. 9 represents these losses in per cents of the losses of the 4½ x 4½ inch motor. Figuring out the relative proportion of the thermal losses of the motors from the areas enclosed by the curves H in Fig. 8, and plotting them also in the same scale of percentages to the losses of the 4½ x 4½-inch motor, one obtains in Fig. 9 the curve T of thermal losses variation with the stroke to bore ratio. These two curves M and T give an easy way for a quick determination of the most efficient for general reasons stroke to bore ratio. Whereas curve M is gradually dropping with the increase of the ratio, the curve T possesses a point of minimum at a stroke to bore ratio approximating 1.5, from which point on it rises on both sides, gradually increasing the rate of its rise. It is quite obvious that the decreasing mechanical losses will more than offset the increase of the losses thermal with the greater than 1.5 stroke to bore ratios, until the rate of the rise in curve T equals the drop in the curve M at the same ratio. In other words, this takes place when the tangents to the two curves at the same stroke to bore ratio form equal but reversed towards each other angles a with the axis of coordinates. The corresponding stroke to bore ratio is the one generally most economical.

The whole comparison in the foregoing has been made under assumption of full motor loads, but it could be carried out also in reference to different rates of motor load, thus affording the determination of the best stroke to bore ratios for varying conditions of proposed motor functioning. However, the error is very slight, if the full load conditions are used for all purposes, because the character of the motor efficiency curves does not change considerably with the load, their actual values being merely affected.

Long-Stroke Motors Have Influenced Lubrication Design

A STUDY of the American cars introduced during the last 3 years shows that the tendency towards forced-feed oiling has grown almost at a proportional rate with the increase in the stroke-bore ratio. The average stroke-bore ratio for the American motor of 1913 was 1.22. In 1912 it was 1.16 and in 1911 it was 1.14. The percentage growth of forced lubrication has been practically along the same line. There is a strong connection between these facts.

The use of a long-stroke motor necessitates the design of a higher cylinder. This necessity is due to two causes, first to the longer stroke of the piston within the cylinder and second the fact that the connecting-rod swings through a greater arc about the wristpin, making it necessary to lift the connection of the cylinder to the crankcase further away from the crankshaft.

A higher cylinder is harder to lubricate by splash than is the lower cylinder. The oil must be lifted to a greater height in the former type, it must be forced through a greater length of piston to cylinder clearance and the splashing must be done at a lower speed. These facts introduce practical difficulties in the way of making the amount of oil supplied proportional to the work of the piston. If sufficient oil is supplied at low speeds while the motor is laboring under heavy loads, too much oil will be supplied at higher speed at lighter loads as when accelerating on lower speeds, etc.

When the designer, after much experimenting, has evolved a correct splash to approximately take care of the variations in speed and work of the piston in order to correctly lubricate the cylinder, he still finds himself confronting the problem of lubricating the connecting-rod and main bearing. Here he finds that the simple splash must be augmented by a supplementary system. To solve this problem and still maintain the splash lubrication for the cylinders a force feed system is introduced independently for the crankshaft bearings. This produces the combination force feed and splash system which has been evolved within the last few years in conjunction with the growth of the long-stroke motor.

In the typical motor using the combination forced feed and splash system the oil reservoir is in the bottom of the crankcase. From here the oil is lifted by a gear pump, driven by intermediate gearing from the camshaft, to a sight feed located on the dash. All the oil passing through the system goes through the sight feed giving the operator a clear view of what his oiling system is doing. After leaving the sight feed the oil flows to a distributing pipe in the crankcase from which it is led through individual leads to the main bearings of the crankshaft. This is the force part of the system. After overflowing from the main bearing bushings the oil runs into the splash troughs where it is picked up by the scoops on the bottom of the connecting-rods and by the force of this contact is beaten into a spray which pervades the entire crankcase, lubricating the connecting-rod and camshaft bearings. The oil which reaches the cylinder by this churning action is led along the cylinder walls by the piston and lubricates this surface.

A step still further in advance is that of making the system entirely force feed. Abroad, where the stroke-bore ratio often exceeds the 1.5 mark, this is becoming general practice.

Daily Care of the Car Is Essential

At the End of Each Day's Run, the Owner or Driver Should Inspect All Parts Carefully

Car Should Be Washed Regularly and All Grease Cups Should Be Kept Filled

THERE is one element in long-distance touring neglect of which often causes the untimely end of a trip before the original destination is reached. This element is the daily inspection and care of the car at the end of the day's run. Amateur tourists as a general rule do not realize the necessity of constant watchfulness for indications of future trouble in a tour of several weeks' duration. They are prone to prefer a hot dinner and bed after a long day's drive through unfamiliar country to sitting up for an hour or so with a vehicle that seems to be in prime condition.

Nevertheless, if it is to remain in that condition, it is the part of duty for the driver to see to it personally that the car recieves a certain amount of nightly attention. No one realizes this fact better than the experienced drivers who pilot the cars in long reliability tours such as the Indiana tour to the coast which finished in Los Angeles, Aug. 4.

Indiana-Pacific Tourists' Methods

With these drivers there was a certain definite nightly routine in caring for the cars and this was gone through before they washed for their evening meal. While this program varied slightly, depending upon the individual idiosyncracies of the different cars, nearly the same procedure was followed with each. The first thought of the driver was to see that the fuel and oil tanks were filled for the next day's run. Then the car was gone over carefully and all grease cups given a turn. Particular attention was paid to the spring shackles. This was particularly important through the rough, hilly country encountered part of the way.

Spring clips and shackles are examined to see that they are not spreading or wearing. Clutch and gearset are examined to see if they are in need of lubrication. One driver made a practice of putting oil in the clutch housing every other night. Others attend to this only once a week. An important part of the evening program is the attention to the grease cups all over the car. When the clutch cone is equipped with grease cups they are given a slight turn each evening. One of the drivers made it a rule to put graphite grease in the universal joints each night.

Looking for Leaks Every Night

Another part of the nightly routine is to glance under the engine for leaks of oil or water and an examination of the gasoline line for leaks also is in order. Special notice is taken for water leaks from radiator or hose connections. Water is a precious fluid in the desert and in the mountains it is used up rapidly climbing the steep grades, so no chances are taken of losing it. So far as the actual washing of the car is concerned, there is little done except under two conditions. The first of these is when sufficient mud is encountered to interfere with the proper examination of the car or when too much dirt and dust is caked on the parts. In this case they are cleaned up temporarily with waste or a rag so that the parts may be examined.

The tires are tested to see that they are holding their pressure and are gone over for bad cuts or other evidence of weakness. This constitutes the nightly routine generally followed. Ordinarily the whole operation does not require more than from ½ hour to 1 hour. If, however, the examination shows the need of tightening up or replacement of parts, the work requires a longer time.

Uusually if any weakness develops it has announced itself sometime during the day's run to the expert eyes and ears of the driver, and when he pulls into night control he is prepared for the longer session the repair may necessitate.

One of the features of the car which requires attention is the braking arrangement. In the mountainous districts the safety of the car and its passengers may depend on the holding power of the brakes, so that one of the features of the evening program in the mountains is the examination and adjustment of the brakes.

The real bath of the car occurs about twice a week when the tour reaches a large town with ample garage facilities. Here the car is given a thorough washing, both the body and the chassis being cleaned. The chassis bath is the more important, because then the accumulation of grease and dirt is removed and a chance for thorough inspection of the car from radiator to tail light is offered. The drivers usually prefer to do this washing themselves, if time permits, not so much because they expect to do a better job, but on account of the chance for inspection that the process brings.

At such times a more thorough lubrication of the car is given than is the rule in the nightly routine. At this washup time, the parts in need of the more infrequent attention are given consideration. The grease cup on the fan pulley is given a turn, the belt is tested for looseness, the oiling of the water pump, the magneto and the electric motor and generator are looked to. Opportunity at this time is taken to see that all the grease cups have a supply of grease—it does no good to turn them down every day if they are not supplying lubricant to their bearings.

Unless the need of replacements or extensive adjustments is found the whole process does not take over an hour in addition to the time required for the nightly task.

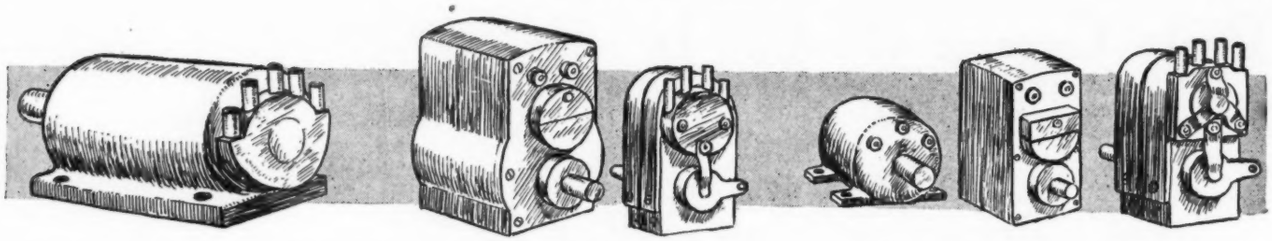
Paint and Varnish Blisters

At this season of the year the painter of vehicles, horse-drawn and horseless, is usually assailed with complaints concerning the above surface disorders; and not infrequently he is held accountable for their development when, in fact, he may be, and usually is, as free from responsibility in the matter as the man in the moon.

When asked for the cause of a case of paint and varnish blisters it is not an easy thing for the painter to give off-hand, even upon an examination, a definite cause, unless he has at hand some detailed history of the case. There are a variety of causes for the development of blisters in a newly finished surface. For example, the hot sun of the spring and summer months, if allowed for a considerable length of time to concentrate upon a recently varnished surface, will raise blisters, and the more elastic the varnish the more certain the blisters. A hard drying varnish, by reason of its smaller proportion of oil, gets out of the way of the sun's heat quicker.

Because of the sensitiveness of the elastic varnish has arisen the admonition handed down through many generations of painters: "Wash the varnish early and often with clean, cold water," which is a good treatment, by the way. Other causes of blisters are, briefly: Unseasoned, or sappy, or resinous, wood. Grease or oil upon the surface. In a word, this latter surface condition is about as certain as death in causing blisters. Blisters come also from the practice of hurrying one coat of paint over another before preceding coat is dry.

The cure for blisters consists mainly in preventing them—in eradicating the sources through which they come. Occasionally they can be punctured and pressed down to a condition not easily noticeable. Again, and perhaps more frequently, the cure consists of removing them, resurfacing and revarnishing.—From *The Carriage Monthly.*



The UNIT SYSTEM The TWO-UNIT SYSTEM The THREE-UNIT SYSTEM

Engineers Disagree on Starter Units

Part VI

Cunningham Engineer Sees No Reason for Discarding the Magneto, But of the Three Starting Types Prefers One-Unit System—Velie Man Likes Three-Units —Briggs Detroiter Representative Finds Merit in Two-Unit Type

The Six Questions

1. *Which will be the eventual system, namely: (a) Unit system, in which starting, lighting, and ignition are combined; (b) two-unit system, in which starting and lighting are combined, with ignition separate; (c) three-unit system, in which ignition, starting and lighting are separate?*
2. *Respective methods of coupling starting motors with the gasoline motor?*
3. *Possibilities of weight reduction in starting systems?*
4. *Increased accessibility of the battery for starting and lighting purposes and if excessive initial draw from the battery is injurious?*
5. *Positive locking means whereby tampering by outsiders cannot lead to shorting and discharging of batteries?*
6. *Movement to discourage senseless demonstrations of starting motors in which they are used to propel the car for a short distance?*

Editor's Note

Readers of THE AUTOMOBILE who are owners and operators of cars are invited to participate in the present discussion on the relative merits of combined starting, lighting and ignition units.

The three systems are best described as the unit, the two-unit and the three-unit types. In the unit type the electric motor for starting, the electric generator for battery charging, and the ignition system are in one. In the two-unit system the battery dynamo and the starting motor may be combined in one machine with a single armature. In the three-unit system there is a starting motor as one machine, the battery charging dynamo is a second machine, and the magneto for ignition is the third.

It is on the relative merits of these types that this discussion hinges. Owners who have had practical experience with them should be able to give points of much value.

THE discussion carried on in recent issues of THE AUTOMOBILE on the relative merits of the three electric systems for automobile use now employed on most of the modern cars has given rise to a number of very interesting communications on the subject from men who know whereof they speak. The engineers of the companies manufacturing such systems, the engineers of the car companies and readers who have had experience with all types have all contributed to the argument. Some of them are quoted herewith:—

Motor Generator System Is Good—Lacy

ROCHESTER, N. Y.—Editor THE AUTOMOBILE:—The art of motor starting is yet too young to permit of an intelligent prediction as to what will be the final system. It is altogether probable that the several principal systems now in use will still be found some pears hence in one form or another. At the present time there seems to be good and reasonable arguments in favor of each system. It does not seem probable to the writer that magneto ignition will be discarded in the very near future, if even at all. Magneto ignition is so entirely satisfactory and simple that it would seem foolish to discard it.

Relative to the starting and lighting question the writer is inclined to favor a system in which both functions are performed by one unit, either by the employment of the so-called motor generator or by means of so mounting the two instruments as to provide only a single drive to the crankshaft. That the separate starting motor provides the most efficient system from the electrical standpoint is almost unquestioned, yet to attach and provide proper drives for both the generator and the motor is more or less of a complication. In most of the two-unit arrangements the motor is geared into the flywheel. This seems objectionable because of the necessity of employment of rather crude mechanical construction and also it is quite noisy. The writer cannot quite understand why a public who has clamored so for quietness can possibly countenance the noise that some of these flywheel-geared starters do make. The most reasonable means of driving this kind of apparatus seems to be by means of the silent chain. The writer is most favorable to those systems which provide driving means of both generator and motor through one good substantial chain, and it would seem to be most desirable that the object should be accomplished by means of the chain drive only, with no complicated train of gears, roller clutches, etc., for the purpose of changing the ratio for generating and starting purposes. One system provides such an arrangement, and during the two years that it has been in use has certainly made a good account of itself. A good stocky "motor generator" which will take care of both generating and starting through one ratio of gearing between armature shaft and crankshaft is certainly the most attractive system from the mechanical standpoint. It can also be made extremely simple electrically. This system in the writer's opinion is bound to come into great favor in the near future.

It is more or less problematical as to what will be developed in the line of the flywheel starter, that is, one in which the flywheel is replaced by the armature of the motor generator, the fields being attached to the crankcase. Such a system is certainly ideal from the mechanical standpoint, as it contains no gears, chains, bearings or other mechanical features which are liable to give trouble. This system is more or less complicated from the electrical standpoint, as it requires high voltage for the starting circuit and low voltage is desirable for the lighting circuit. Even with this electrical complication this type of starter will undoubtedly cut quite a figure in future development.

The keynote of future lighting and starting development must

be along the lines of simplicity, both mechanical and electrical. Those systems requiring more or less intricate trains of gearing, together with roller and friction clutches, etc., are bound to be superseded by systems which are free from these complications. At the present time the public will take almost anything that is presented to them in the way of a starter, but this condition will not survive very long.

It is most regrettable that the starter was in the early stages exploited as a convenient means of moving the car around the garage, or for the purpose of crawling home when the gasoline tank is empty. It was a great mistake for starter manufacturers and also car manufacturers to even mention to the public that their devices would do these "stunts." No starter has yet been developed which will stand up for even a short time under such service. In order to avoid trouble which is certain to come from such use of the starter system car manufacturers will of necessity have to withdraw their guarantee in case the apparatus is so used. Everything possible should be done to discourage the practice of using the starter for any other purpose except for that for which it was built.—Engineer JAMES CUNNINGHAM, SON & Co.

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Three-Unit Type Is Most Perfect—Rose

MOLINE, ILL.—Editor THE AUTOMOBILE:—Taking the points up one by one, the writer does not pretend to say what would be the eventual system. However, at the present time the best system by all means is the separate or three-unit system. There are several reasons for this:

1—During the life of the electrical industry, electrical engineers have endeavored to build a successful and efficient combined motor and generator. No one has been able to do this up to date, due to the widely different construction of the two units. The generator requires windings of comparatively fine wire and a large number of these windings to deliver the current efficiently. The motor requires windings of a comparatively coarse wire and a small number of them to deliver the necessary power. In the writer's opinion it is necessary to cut down either the efficiency of the generator or the motor in building a combined unit.

2—Respecting methods of coupling starting motors with the gasoline motor, the most simple, most efficient method and the one least liable to give trouble is starting from the crankshaft through a silent chain with a properly constructed overhanging clutch in the line. The widely used gear-meshing with a gear cut in the flywheel is not satisfactory, due to the fact that there are sliding gears to engage which necessitates a resistance in the starter switch which is liable to give trouble and must be delicately adjusted. This is also found to be noisy, providing the gasoline engine is turned over at a reasonable speed.

3—Increased accessibility of the battery for starting and lighting purposes and if excessive initial draw from the starting battery is injurious. The battery should be located in an accessible place. A battery needs a certain amount of attention. It must be kept filled with distilled water, and if a battery is placed in an inaccessible place the user will not give it the care that it should have, and as a consequence the battery will be short-lived.

Excessive Battery Draw Is Injurious

In regard to the excessive initial draw from the battery, this is injurious, providing the battery has been constructed with this end in view. If a good conductor has been introduced into the plates to take care of this excessive discharge and reduce the resistance, there is no reason why the battery should not stand this service.

4—Positive locking means whereby tampering by outsiders cannot lead to shorting and discharging of batteries. This should be taken care of as it is an undisputed fact that tampering with a battery by some one who understands nothing about same is liable to give trouble.

5—Movement to discourage senseless demonstrations of starting motors in which they are used to propel the car for a short distance. Such demonstrations should be discouraged. A starting motor is put on a car to start the motor—not to propel the car. I believe that some of the manufacturers who are building self-starters have used very injudicious advertising by stating that their outfit will propel the car for a certain distance. This certainly can do the starting outfit no good and will eventually cause a considerable harm.—C. B. ROSE, chief engineer, Velie Motor Vehicle Co.

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Simplicity Is Most Important Feature—Lee

DETROIT, MICH.—Editor THE AUTOMOBILE:—Concerning the advisability of the use of any device on a motor car it would seem that the first consideration would be simplicity. Nowadays people want what they pay for to be the best, and the greater number of systems utilized on a car, the greater the cost or cheaper material and poorer workmanship will result, unless the cost reaches beyond the limit of the greater buying public. However, it is not alone a matter of cost that should be taken into consideration. When one realizes that practically all of the functions such as lighting, ignition, starting and gear shifting may be accomplished through one medium, electricity, it would seem that the only natural thing would be to use it, as it is more practical than oil for side and tail lights, acetylene for the head lights, a magneto for ignition, and an extra electrical equipment for starting; four distinct units in all.

As to the number of units necessary in electrical starting the adaptability of the car will no doubt play a considerable part. No doubt the simpler method is the simpler unit, that is, a generator and the starting motor combined enclosed in the flywheel case, the same being designed to meet the extra conditions. However, it does not seem that the single generator-and-motor unit is properly perfected or simplified to such an extent that it could be used on a popular priced car. Therefore, I consider the next best proposition, the two-unit system, having a generator with breaker box and distributor integral, and a separate starting motor which may be geared by whatever means most practical to the case at hand, and using a storage battery sufficiently large to take care of over charging, furnish lights and ignition, as well as current for starting.

Poor Application the Rule at Present

It must be understood that in making use of the electric starter on cars already designed many and various conditions present themselves which must be met by whatever way seems most practical. The greater majority of starters cannot be attached to cars already designed so that they look to be a part of the car. We find them standing on end, angles, and horizontally, and placed in the most inaccessible positions imaginable. This, however, is to be expected in the early stages of any business, and will soon be corrected.

Electric Starters Not Well Advertised

In the next year or two many criticisms will be aimed at the electric starter which could have been eliminated by proper advertising. Even now, about the first question the customer will ask is, "How far can you run your car on the electric starter?" One would think that the starter was supposed to snake a car that was out of gasoline from New York to Boston. Demonstrators will be showing customers how long their starter will spin the motor and the customer will never tire of showing his neighbor, and in the meantime they will be using reams of paper telling the maker his troubles about warped and run-down batteries and how impossible it is to keep them supplied with water. No one doubts the necessity of the good electric starter and its ability to give perfect satisfaction, but before they can do so the users must know they have their limitations, that is, they are made for starting the motor and not for climbing hills, or for even ordinary road work.—W. S. LEE, engineer, Briggs Detroiter Co.

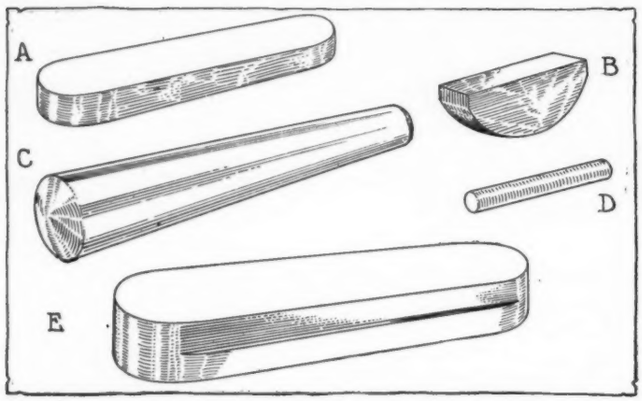

Fig. 1—Types of keys used in automobile construction: A, flat, sunken key; B, Woodruff key; C, taper pin; D, round, parallel pin, and E, step key

Keys and Keyways for Automobile

Types, Sizes and Fitting of Keys and the Corresponding Keyways for Motor Car Work

A Clear, Concise Exposition of the Subject in Two Parts, for Owner, Garageman and Repairman

Part I

IT is proposed in this article and the one to follow on the same topic, to show by illustrations and to explain in a practical manner about the keys that are used in automobile construction. This article will take up the subject from the beginning, illustrating the different kinds of keys and describing same, then giving the formulas for determining the proper size that a key should be in relation to the parts to which it is intended to be assembled, and then illustrations showing their application, and these examples will show the part of the car to which each is most applicable. In addition tables of standard keys will be given and the form for using these will be taken up in detail. The article to follow will deal with the material and the treatment of same, and the method of making keys and keyways, etc.

Keys are used to transmit torque or twisting effort from one revolving or oscillating part to another, and their primary use is to connect parts that are intended to be separated in case of repairs.

Fig. 1 shows the most common types of keys and they comprise all that are used on automobiles. The first is the flat sunken key A. It is wider than it is deep and the ends are rounded.

The Woodruff key shown at B is like a round, flat disk that has been cut in two in the middle. The circular part fits into the slot in the shaft and the diameter fits into the slot in the hub.

C shows the taper pin. It is used for light work, where only a small amount of twisting action occurs.

D shows a round, parallel pin, that is used sometimes as a precautionary measure.

E is the step key, and is used only on repair work.

Determining Size of Key

One of the most important essentials about keys is to know the size that a key must be in order to do its work; in other words, its proportionate size in relation to the parts to which it is intended to be assembled. There are established formulas for this, and each will be taken in turn and examples given. Fig. 1, the sunken key, is governed in size by the following:

D = diameter of shaft
W = width of key
t = thickness of key

$$W = \frac{D}{4} + \frac{1}{8}, \text{ and } t = \frac{W}{2}.$$

To more clearly illustrate this, take an example and use the above formula. Assume that D, or the diameter of the shaft, is 2 inches, therefore W will equal $2/4 + 1/8 = 5/8$, and t will equal $5/8 \div 2 = 5/16$, accordingly the proper size for a sunken key for a shaft 2 inches in diameter is 5-8 inches wide by 5-16 inches thick, and the length is twice that of W, or 1 1-4 inches. This latter dimension is governed more or less by the length of the hub.

At this time it will be opportune to speak of the keyway for a sunken key; on this point there seems to be some diversity of opinion as to the proper method of measuring for the depth.

Fig. 2 shows a section of shaft and sunken key assembled, and

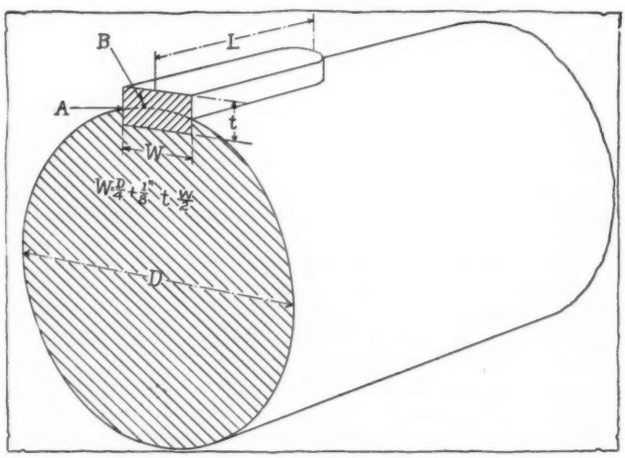

Fig. 2—Illustrating key fitting, method of determining depth and width

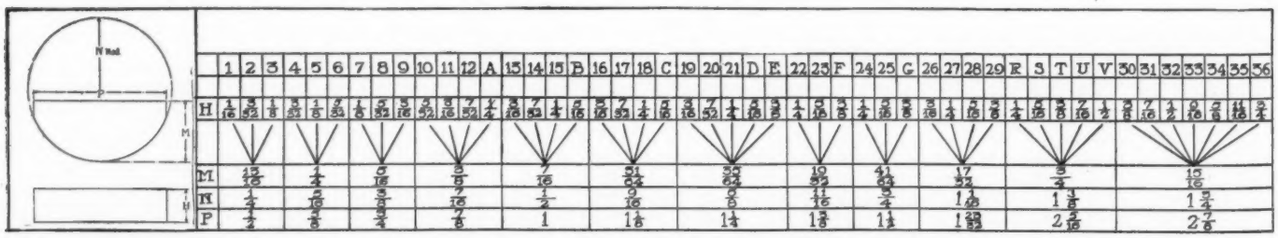

Fig. 3—Table from which various sizes of keys may be obtained. In the diagram N is the radius cut in the shaft and H the width of the key

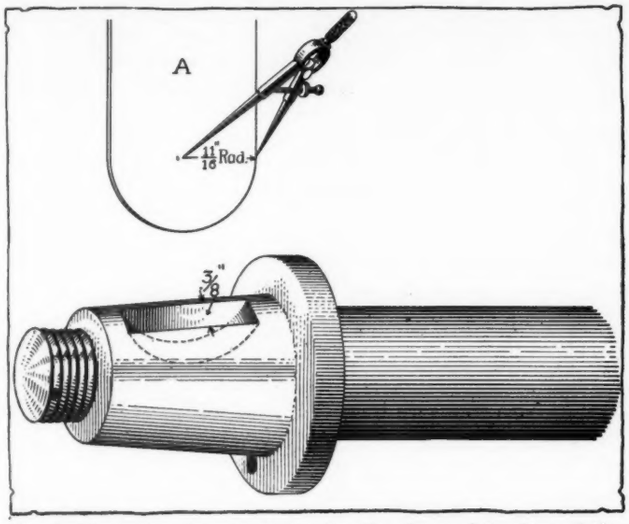

Fig. 4—Illustrating how to determine the size and location of the Woodruff key for a taper shaft

B on this figure is the point from which theoretically the depth should be located; the argument to support this claim is based on the amount of torque carried by the wedging action of the key; in practice, however, except on rare occasions, keys are not fitted top and bottom but on the sides only; therefore, we can figure only on the shear and not on the wedging action. The result is that in practice we register the depth from A. This will make no difference in the thickness of the key, but the keyway in the shaft will be a little deeper and that in the hub not so deep.

To determine the size of a Woodruff key the same formula will apply for W or the width. For the other two dimensions, thickness and length, there is not any formula used in the shops; in fact, there are so many different sizes of standard keys, and many of them have so little difference in size, that it is rather a matter of experience in determining the choice, and the table Fig. 3 gives the sizes as well as the order number of all standard keys.

Using Table of Key Sizes

In order to give an example of making a selection from this table the illustration of a bevel pinion shaft is shown on Fig. 4, and the keyway for a Woodruff key is shown. Assume that the key in this shaft has been sheared off and you wish to order another and you do not know the number of the old key. The first step is to find the radius of the cut in the shaft. A on this figure is a piece of tin that has been cut with shears until it fits the keyway, as the tin is thin it is easy to see when the fit is sufficiently accurate; then, with a pair of dividers find the radius of the circle. In this illustration this is found to be 11-16 inch and the width 3-8 inch. Knowing now the radius and the thickness of the key, proceed to find the number from the table Fig. 3.

How To Find Correct Number of Key

Looking at the diagram on this table we note that radius corresponds to N and that width corresponds to H. Having this established we follow along the line marked N until we come to 11-16, then we select from the lines that radiate from the vertical line the one that is marked 3-8, and directly above this is the letter F. And this is the correct number for ordering this key from any dealer, because everything that has been established from this table in this example is standard practice.

Taper pins are proportioned to their work, according to the following formula: The mean diameter of the pin equals 1-5 the diameter of the shaft. The table Fig. 5 shows the dimensions and numbers of standard taper pins. For the purpose of B on this figure is the point from which theoretically the depth should be located; the argument to support this claim is based illustration, the following example is given and worked out, and shows the method used to select from this table the proper sized pin for any given size shaft. Suppose that the shaft is 1 1-2 inches in diameter; then, according to the formula given, the mean diameter of the pin will be 1-5 of 1 1-2 = 3-10 or .300; then from the table, under the heading "Diameter of Pin Center in Thousandths," we select that figure which is nearest to .300, and when the exact size sought is not in the column we select that which is nearest to and slightly larger, which in this case is .310, now horizontally in line with the figure found; we follow back on the line to the first column at the left, under the heading "No. of Pin," and find that No. 6 is the right size for a shaft 1 1-2 inches in diameter. This table, as well as that given of Woodruff keys, contains only the standard numbers that can be purchased.

Moving on to the round parallel pin, the same formula for the size for any specific work as that given for the taper pin is used, namely, one-fifth the shaft diameter is the diameter of a round parallel pin. When made in this proportion the results are satisfactory.

At E, Fig. 1, is a key that is made to fit each job; it is used only for emergency repair work; it is pressed into service when the regular key has become loosened, either through irregular torque or vibration and the keyways have become worn. In dressing out the keyways in the shaft and the hub it may be necessary to use a larger cutter on one or the other; in order to cut away the worn edges a key is then made with a step or offset to fit the different width keyways.

Uses of Various Types of Keys

The five different varieties of keys here shown have their different uses, and the variety of shapes make it possible to meet the requirements of different conditions.

Of the five keys the flat, sunken key A, Fig. 1, is the strongest, and it is only used where heavy torque is to be transmitted. It is the most expensive form of keying, and on the automobile its use is confined to securing the transmission gears to the shaft. Fig. 2 is an illustration that shows an assembled key and shaft.

The Woodruff key is more generally used than any other type, and makes a splendid manufacturing proposition and gives

No. OF PIN	PIN LENGTH IN INCHES	LARGE DIAM. IN THOUSANDTHS	APP. FRACTIONAL SIZE	DIAM. OF PIN CENTER	APP. FRACTIONAL SIZE	SMALL DIAM. IN THOUSANDTHS	APP. FRACTIONAL SIZE
0	1	.156	5/32	.145	9/64	.135	1/8
1	1¼	.172	11/64	.159	5/32	.146	9/64
2	1½	.193	3/16	.177	11/64	.162	5/32
3	1¾	.219	7/32	.201	13/32	.183	3/16
4	2	.250	1/4	.229	15/64	.208	13/32
5	2¼	.289	19/64	.264	17/64	.240	1/4
6	3¼	.341	11/32	.310	5/16	.279	9/32
7	3¾	.409	13/32	.370	3/8	.331	21/64
8	4½	.492	1/2	.445	7/16	.398	25/64
9	5¼	.591	19/32	.536	17/32	.482	31/64
10	6	.706	45/64	.612	39/64	.581	37/64

Fig. 5—Dimensions and various sizes of standard taper pins in use at the present time

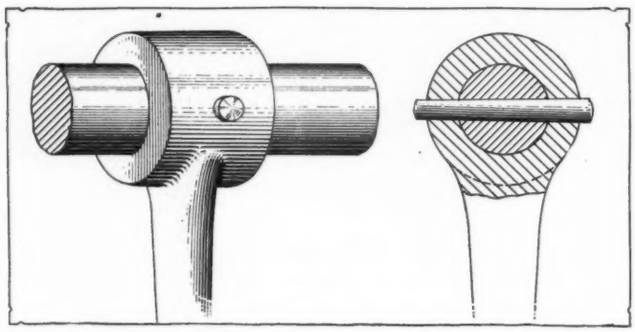

Fig. 6—The taper pin is here shown assembled and keying a brake connection in place

uniform results in operation and there are a large variety of standard sizes to choose from. Some parts of the car where this key is used are the gearset rear axle pinions, timing gears, etc. Fig. 4 shows the keyway cut in a shaft preparatory to inserting the key.

The taper pin C, Fig. 1, is illustrated on Fig. 6, where it is shown assembled and keying a brake connection; this shows the work to which the taper pin is made to serve on other parts of the car; strange as it may seem, the taper pin not only does not give trouble by working loose owing to the very slight taper, but, on the other hand, it is sometimes impossible to drive it out. In this case it is best to saw the end off and drill out the center, which releases the pin.

The round parallel pin is illustrated assembled in Fig. 7, where it keys a magneto gear to a shaft. In this the work consists in registering the location of the gear; and the drilling for the pin is done at assembling and after the gear has been located right for timing.

(To be continued.)

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The Use and Abuse of Spanners

THE spanner being a familiar tool to the merest motoring tyro, notes concerning its use may at first sight appear somewhat superfluous. There is no question, but that very few owners or drivers do use a spanner correctly; let anyone who doubts this statement make an inspection of a few second hand cars. Nuts that manufacturers go to infinite trouble to produce to within a few thousandths part of an inch of a given measurement are twisted and worn to a degree that sets an engineer's teeth on edge. The quality of the spanners supplied with the car, too, is in many cases not the best.

The most abused spanner is that of the adjustable type; it requires more careful handling than a solid spanner, and for that reason it should only be employed as a last resort. Owners and drivers should see to it that there are two solid spanners to suit all nuts from 3-16 inch up to 1-2 inch or the largest size nuts on the car, excluding such parts as hub-caps for which special ring keys are generally supplied with the car. Spanners, like most other commodities will not last forever. After a while the jaws may start to spread. Then, instead of the spanner fitting snugly alongside the adjacent flats of the nuts, it will just catch the corners, and sooner or later, when undoing a tight nut, the spanner will slip around, taking away the corners of the hexagon. Once the flats are rounded off, the nut will probably come to an ignominious end by being unscrewed with the aid of a hammer and chisel. A spanner made from a high-grade steel-stamping will, if treated properly, last a very long time, but many tool kits are made up of poor quality malleable iron spanners and such tools cannot be trusted when a tight nut has to be undone. Another point on which we would caution the amateur is that of being careful to get the whole of the nut within the grip of the spanner. By attempting to unscrew a nut with only half the jaws of the spanner over the flats, unnecessary strain is put both upon the spanner, tending to cause its jaws to open out, and upon the corners of the nut. Never hammer the spanner to unscrew a tight nut; if the nut cannot be removed in the ordinary way after being soaked in paraffin, thread a piece of tube over the stem and obtain greater leverage by that means. Don't use a spanner as a hammer; it is not intended for that purpose.

For a reason that appears to have no justification, pipe-union nuts are of a size not corresponding with any bolt head or nut for which solid spanners are to be procured; therefore resource has to be made to the adjustable wrench. In using a spanner of this description the first essential is to put it on the nut the right way round, that depending upon the direction in which the nut is to be turned. The right and wrong methods are clearly shown in the accompanying illustrations. A point must be made of placing the nut as close to the shank of the spanner as possible, and seeing that the jaws are screwed up hard on to the flats of the nut. It is bad practice to attempt to unscrew or screw up a nut with the jaws of the spanner parallel with the bolt; so doing puts a strain upon the shank that it is not designed to stand. An adjustable spanner is, comparatively speaking, a delicate tool needing careful handling; once strained out of its proper shape, it not only becomes awkward to adjust, but the jaws not being parallel, irreparable damage is done to the nuts. The use of either pliers or pipe-grips where a spanner ought to be employed is emphatically to be tabooed—From *The Car.*

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Wiring Connections Need Care

ALL automobilists are familiar with the nuisance of broken connections in the wiring system of the car while on the road. This loosening of the wire most often takes place at terminals, and owing to the average attitude of most people to electrical matters it is generally looked on as an inevitably frequent occurrence. This is not so. It is more often due to an unfair or careless treatment of the wiring, especially at the points of connection to battery switch or other unit in the system.

It should be remembered that simply to turn the end of a copper wire around the binding screw of a terminal is an inadequate manner of connecting up if permanency is required, and particularly on a vehicle that is subject to the jolting and road shocks that the automobile is heir to. A terminal connection of this sort is even worse when the cable is of the flexible type.

There is no means of being absolutely free from loose connections but the trouble can be reduced to an immaterial amount by adopting the proved methods of the electrician at the outset. A cable eye should always be used at the end of every wire. The proper way is to solder this on, but if there is no time for this operation, or facilities are not available at the time, a good substitute is that kind of eye provided with a recess in which it is a simple matter to permanently attach the wire by hammering close.

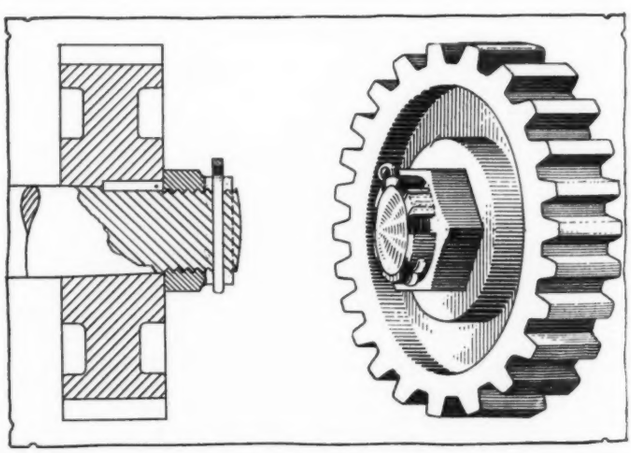

Fig. 7—The round parallel pin keying a magneto gear to its shaft

The Engineering Digest

Glimpses From New Art of Foundrymen—Rapid Ocular Measuring of Torque—Twin Sparks in T-Motors—Improved Gas Burner—Speed Governor on Ignition

FOUNDRY practice enters more and more as a factor in the production of complete automobiles because the car builder cannot afford to depend on outside supplies; and, as it has undergone radical changes during the last decade, largely through the demands of the motor industry for uniform and dependable results and by the introduction of machinery for handling the molds, the cores and the finished castings, a glimpse of the principles which are now being pronounced as leading in this art should reveal something of timely interest with regard to the equipment and other preparations necessary for success in this line, especially among those who have not so far given the subject the same attention that has been devoted to mechanical processes.

The question of the sand used for molds and cores comes under consideration in the first line whenever it is contemplated to establish a foundry department for automobile parts in any given locality, partly because the cost of transportation for laying the sand down at the foundry may be considerable and partly because the efficiency of different sands for different types of castings varies from 4 to 20 tons of molds from 1 ton of sand, while the cost of removing old sand which cannot be used any more grows in inverse proportion to its efficiency. A. L. Curtis, a British specialist on the mixing and treatment of molding-sands, presents some of the main considerations in this matter in *Revue de Métallurgie* for August. According to this authority, the principal difficulty with which foundrymen have to contend with lies in producing from day to day any given mixture or composition of sands and binders from the material at their disposal. While quartz and feldspar predominate among the ingredients of molding-sands, a large number of other minerals are intermixed with them in smaller or larger proportions and greatly influence the foundry work; the effect being that the treatment and mixing of different sands must be varied judiciously and accurately if the best results shall be attained. The first requirement is therefore that the composition of each lot of sand must be investigated and recognized, for which purpose a microscope with polarizing prisms is only one of the necessary accessories. Some knowledge of geology, petrography and mineralogy, chemistry and pyrometry, the latter for observation of the action of the particles at high temperatures, and of other kindred sciences and arts, is necessary. Curtis supplies a list of about 35 minerals whose presence and proportions in the molding-sand it is needful to ascertain and whose effects upon the foundry work should be known.

After the screening which separates the sand into classes according to the size of the grains, the most important point to be determined relates to the fusion points of the particles of which it is composed. An oxy-acetylene burner or other gas burner and an optical pyrometer are here the principal tools and, if the object in view is steel castings, little carefully dried trial-molds must be made and steel must be run into them to try the effects.

The next important point is the density of the sand or the degree to which it can be compressed in any given mold, for which purpose Baird & Tatlock of London make a special instrument which registers the pressure. In the case of artificial sand mixtures, and especially when old sand has been treated with plastic clay for bronze or steel castings, the plasticity of the refractory clay used should be measured, as clays otherwise similar vary much in this respect, and for this measurement another special instrument has been placed in the market. By its use, coupled with treatment of unsuitable materials with colloids or acids, the desired qualities may be produced in molding-material which would not otherwise give good results.

Curtis holds that the machines usually installed—where machines are used at all for the preparation of the sand—such as wet or dry mills, crushers and pulverizers, are unsuitable for producing correct mixtures, because they do not provide means for regulating the degree of moisture or for employing the water as an agent for dissolving and thereby pulverizing and distributing constituents, such as glucose or oil, which are incorporated in the sand—nor in fact for any accurate proportioning of ingredients. He has devised a series of machines through which the composition is controlled mechanically by means of regulated water pressure.—From *Revue de Métallurgie,* August.

Leading American Practice in Core-Making as Explained To Foreign Experts in the Arts of Foundry Work

OILED sand cores are commonly used in American foundry practice, as described in a paper by Henry Marquette Lane read before the convention of the Technical Association of Foundrymen held in Paris during the last week of May this year. Hundreds of foundries in the United States use more than a hundred dollars worth of oil for core-making each week, and some of them use as much per day. The leading principles in this practice are, briefly, as follows:

A distinction is made between binders used for green sand and those used for dried sand. The binders in common use are (1) oils, comprising (a) siccatives such as linseed, cottonseed, soya, fish and sperm oil and (b) mixtures of siccative oils with resins dissolved in mineral oil; (2) binders prepared from pitch or resins which hold the sand together when melted; (3) pastes prepared from flour or starch, and (4) binders soluble in water, such as stale beer, residues from the distillation of rum, molasses, glucose, paper pulp preparations.

Some binders have conflicting effects while others may be used in combination. The specialized establishments in America have standardized the compositions and methods to be employed in the different branches of foundry work. Thus, oiled sand is almost exclusively used for the cores of tubular parts of up to 4 inches in diameter and for the waterjackets of automobile motors; also for radiators. The pitch base is used for the cores in large motors and for mechanical constructions in general. Aluminum foundries use cores prepared with resin which soften when the metal is poured and thereby obviate cracking of the molds. A mixture of clay and sawdust is employed for the cores of large castings. For drawplate-cores oil is combined with flour pastes.

All cores made from oiled sand can be dried at a temperature of 250 degrees centigrade or a little higher. Those made with flour, starch or dextrine should not have more than 120 to 150 degrees. The cores made with soluble binders can be dried at any temperature up to 205 degrees.

For mechanical core-making either rock-over machines or

vibrator-machines are generally employed, and during the last few years pneumatic devices have been used for replacing the sand in the corebox and tamping it.

The greatest direct economies in foundry work have been realized through the replacement of handwork by machines in the handling of materials and when the work passes from one stage to another. Some rules have been adopted for these operations. For example:

(1) In the handling of moistened sand do not expose the sand in thin layers to the action of the air, lest the water evaporate.

(2) Take all the supplies which the workman should use direct to his bench and remove the cores as fast as they are made. For the latter purpose, the ordinary mechanical means (cranes, moving platforms or cars) have not been found suitable; for, while the workmen who are farthest away from the drying-ovens can always find a space where they can place their cores, those who are nearest to the ovens frequently find all the space occupied. In some foundries continuous roller-tables, similar to those used in rolling-mills, have been installed, and the workmen push their work onto them of their own accord as soon as it is ready.

(3) After drying, the cores should be placed in closed boxes where they remain up to the moment when they are to be used.—From *La Technique Moderne,* August 15.

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It is related that the principal trouble experienced with motor-sleighs used for the antarctic expeditions of Scott and Shackleton consisted in overheating of the air-cooled motors, and it is surmised that the reason for this unexpected result lay in the extraordinary dryness of the atmosphere. It is not stated whether fans were dispensed with on the theory that arctic temperatures would be sufficient for disposing of surplus heat despite the slow pace to which the other conditions reduced the vehicles.—From *Automobil-Rundschau,* August 15.

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Backfiring Obviated In Acetylene Burner By Passing Gas Through Capillary Screen In Nozzle

IN a new acetylene burner for autogenous welding and metal-cutting, backfiring in the burner is obviated by the construction shown in Fig. 1. The nozzle of the burner has the form of a pear into which the oxygen and the acetylene pipes are received in different compartments separated by a thick partition *p* which is perforated with a large number of very small holes *l*. The acetylene pipe *a* stops in compartment *f* while the oxygen pipe *s* pierces the partition and delivers a very strong stream of this gas through jet *d* in compartment *k* opposite to the discharge aperture of the pear-shaped nozzle. The shape of the latter has the double advantage of facilitating an intimate mixture of the two gases and of making room for a partition of sufficient area, so that the total section of the small holes in it can admit acetylene in the desired proportion. If an explosion of the mixture in compartment *k* is produced, it cannot be transmitted to compartment *f* by reason of the length and fineness of the holes *l*. The tube *s1* which branches from pipe *s* is used only for the metal-cutting, supplying the oxygen for this purpose.—From *Le Génie Civil,* August 16, after *Praktischer Maschinen-Konstrukteur* of April 3.

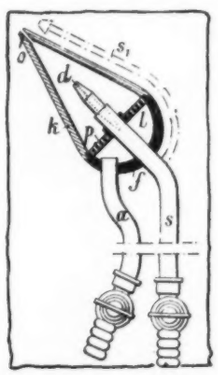

Fig. 1—New nozzle for oxy-acetylene burners

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At the automobile exhibition in Munich, Bavaria, it was observed by Von Loew, that the C-spring which Renault introduced in 1908 and made popular, so that almost all other large manufacturers of automobiles adopted it for limousines, has now been dropped by Renault himself. From the American exhibits the same observer, who is first of all a champion of the German industry, draws the inference that "uniform and generally recognized principles for automobile construction, such as are honored in Europe, have not yet been formed." That this is not intended as a compliment appears from the added clause to the effect that "on the contrary, each manufacturer only tries to satisfy his patrons with the cheapest possible construction he can devise." The noted theorist condemns with special denunciation the practice of building the gear box in one piece with the rear axle.—From *Allgemeine Automobil-Zeitung,* August 16.

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Question Raised If Ignition By Two Sparks Can Take Place of One Gear With Large Gentle Motors

MOTORS of the T-shape, with the valves on both sides, possess a certain advantage which is not widely known or appreciated, aside from the symmetry of the cylinder casting. Their action, which is generally soft, is influenced, more than that of other motors, by the use of two sparks instead of one. The force and violence of the explosion are so much increased by igniting the gas at two points widely apart in the broad combustion chamber that the additional power produced by this means usually is sufficient for climbing a hill which with other motors would require a change of gear. This is the subject for a communication to *Omnia* of August 16 by a motorist who has become impressed by the convenience of the expedient in the case of a car which was not his own. This was a 50-horsepower car which is regularly equipped with a twin-spark magneto arranged so that one of the spark plugs can be switched in or out of the circuit by kicking a lever in the dashboard; all with a view to the regular utilization of the advantage mentioned. If both sparks are used for ordinary travel the action of the motor and the riding qualities of the car become harsh and unpleasant, but at high speed and on hills only the desirable effects are noticeable. In the particular motor which had been observed one of the plugs was placed so as to project less into the gases than the other and this arrangement was said to produce the best results, but had been made to avoid fouling from splashed oil.

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Tar oil, which is among the fluids contemplated as fuel for future automobile motors is not, as commonly believed, a viscous semi-liquid substance like the coal tar from which it is produced, but possesses a high degree of fluidity. It has no odor and burns without leaving any residue and without smoke.

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Torsion-Dynamometers and Their Field—The Latest Type With a Still Later Improved Reading-Device

THE most rapid method for ascertaining the torque of a rotated shaft is realized by means of a torsion-dynamometer. It depends on the fact that, when power is transmitted through a shaft or flexible rods, these are twisted to a certain degree and that within certain limits the angle of the torsion is accurately proportionate to the torque transmitted. For measuring the power of motors, the method has the advantage over a brake test that it can be applied while the motor is at work, so that it can be used for determining how much power is absorbed in work of a certain kind. As it generally consists in a coupling interposed between the driving and the driven machine, it is well adapted for measuring, for example, the power required for driving any machine-tool in a factory at a given speed. On the other hand, it is not so well suited for measuring the output of motors which run slowly and with variable resistance, where the torque cannot be determined by a reading at any point of a revolution of the driving-shaft and, by reason of the necessary length of the coupling, it may be difficult in practice to use it for measuring the power used for driving an automobile on the road.

The main difference between various models of torsion-dy-

namometers lies in the provisions made for reading the angle of torsion, which may be done by electrical, optical or mechanical means. A new optical method which gives especially satisfactory results has now been tried at the laboratory of the Technical Highschool at Charlottenburg, Berlin, in connection with a slightly remodeled torsion-dynamometer made by Amsler Bros. of Schaffhausen, Switzerland. The details of the dynamometer are shown in Fig. 2. The flanges *a* and *b* are secured respectively to the driving and the driven shafts, and *c* is the rod acting as a torsion-spring for transmitting the work. The squared ends of this rod are inserted slidably in the pieces *g* and *h*, and it can conveniently be exchanged for another rod of different diameter. It is surrounded by a tubular shaft which carries the indicator device for the measurement of the angle of torsion. Two jaws and corresponding dogs prevent torsion of the rod beyond the admissible limits. By reason of the rigid connections of disks *d* and *e* with one end of rod *c* and of the disk *f* with the other end, the latter disk is displaced relatively to the other disks the same angle as the two end-fastenings of the rod. The edge *t* of disk *f* is made of transparent celluloid on which a measuring-scale is traced.

In the original instrument the measuring was done by means of two graduated celluloid quadrants, *n1* and *n2*, which were laid into the edge of disk *e* diametrically opposite to one another, but in the remodeling the quadrant *n2* was taken out and so replaced as to be in the same plane with the ring *t*. The original construction provides for the observer looking either directly or by means of a stationary mirror through a fine radial slit in disk *d* at the scale and the quadrant, which are illuminated from behind by means of a bulb-lamp *l*.

The improvement which was the subject of the test was patterned after a method devised by Brodhun for photometric purposes and described by him in 1904. It consists in using a mirror which is secured to disk *d* at an angle of 45 degrees with the axis of the apparatus and is rotated with this disk and which, furthermore, is placed at the same distance from the axis as from the quadrant and the scale, so that the image which it reflects of the latter falls in the axis. If one now looks, either through a telescope which is secured vertically to the axis or directly with the naked eye in the same direction into the mirror, the scale and the quadrant are seen plainly. When the scale is turned, the image is also turned a little around the axis so long as it remains visible in the telescope or to the eye. But as the mirror is very small, the angle observed can only be very small and the change in the location of the image is barely noticeable. When the shaft is turned slowly, the image alternately appears and disappears, according to whether the mirror is in the field of vision or not. When, however, the shaft is turned rapidly, a continuous and distinct image is obtained, provided the scale and the quadrant are sufficiently illuminated and care is taken that the field of vision remains dark during the periods when the mirror is not in it. [The action is the same as when one sees plainly what is going on behind a board fence with crannies between the boards by passing rapidly before it in an automobile.—Ed.]

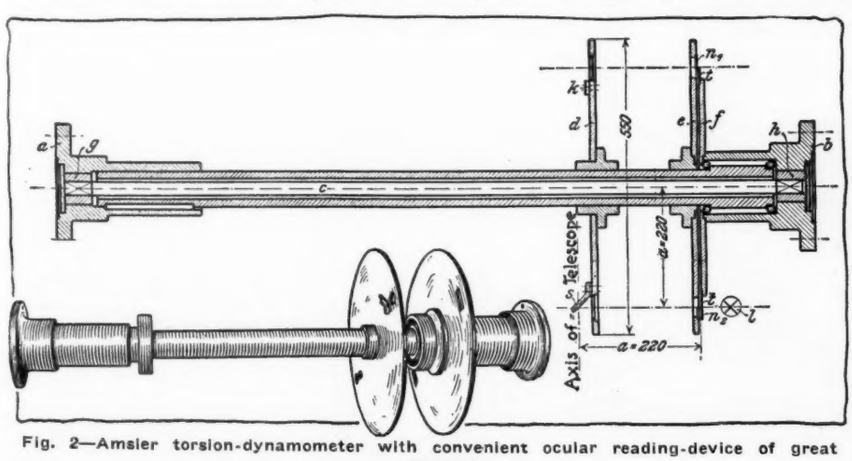

Fig. 2—Amsler torsion-dynamometer with convenient ocular reading-device of great accuracy

As a weight of 1 gram produces a centrifugal force of 1 kilogram when turned around at a distance of 10 centimeters from an axis with a speed of 3,000 revolutions per minute, the securing of the mirror to disk *d* and the balancing of the masses had to be especially safeguarded at the tests. The mirror was a silvered glass surface, to avoid all parasitic reflections, and this was substantially framed and secured to the disk with steel scews which were again secured. A corresponding weight was fixed at the opposite edge of the disk. The total weight of the mirror became 40 grams and, as its distance from the axis was 21 centimeters, the centrifugal pull developed at 3,000 revolutions amounted to 84 kilograms.

The quadrant and the scale were illuminated with a 50-candlepower bulb with matt glass. To keep the field of vision dark so long as the mirror was not in it, all the other parts of the dynamometer were made a dull black.

The advantages of the improved method over that for which the instrument had been intended consist in the brighter and much sharper image obtained and in the avoidance of all parallaxis. [When a clock is looked at slantwise there is "parallaxis" owing to the distance between the hands and the dial.]

It is possible by this method to take readings of 1/100 degree which with a diameter for the scale of 12 centimeters—instead of the 42 centimeters in the apparatus employed—corresponds to an arc of about 0.02 millimeter. Or, in other words, the size of the device and therewith the air-resistance, which is not a negligible factor in the measurement of small powers, can be considerably reduced.

Nothing stands in the way of using two mirrors and two scales instead of one, so as to obtain a check on errors which might be caused by flaws in the concentricity of the disk and the scale. They would have to be placed at opposite parts of the disks and their angle would have to be a little less than 45 degrees for one and a little more for the other, so as to keep the two images distinct and separate.

The dynamometer is justified statically by placing cranks at both ends, loading these with opposed weights and taking note of the angles of torsion resulting.—From *Zeitschrift des Vereines Deutscher Ingenieure*, August 2.

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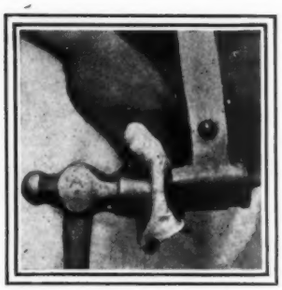
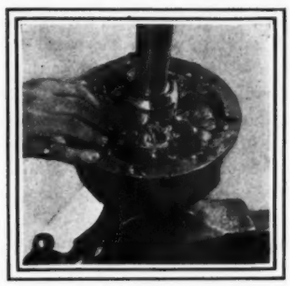
Governing Vehicle Speed Automatically By the Spark

CONSIDERING that it is very desirable to have a simple speed check for motor trucks and delivery wagons without interfering with the full development of motor power, when this is required, a sort of hit-and-miss governor has been devised which acts on the ignition. According to the description of this device given in *La Vie Automobile* of August 16, the governor is mounted so as to revolve with any of the shafts of the motor or of the vehicle—camshaft, pumpshaft and magneto-shaft being specified as suitable—and when the speed reaches the maximum, the weights of the governor effect a contact with wires which pierce the stationary casing of the device and which are connected to the ground wire of the magneto, thereby cutting out the spark. But, in order to check the vehicle speed and reduce it to a certain definite maximum on whatever gear the vehicle is running, it seems necessary that the device should always be mounted upon either the drive-shaft or the jack-shaft. Even so, it would not affect the joyful coasting in which truck-drivers and delivery-men frequently indulge, with the motor disconnected.



The Rostrum



Relation of Locality to Stroke-Bore Ratio

EDITOR THE AUTOMOBILE:—After following the articles by Mr. Batzell in THE AUTOMOBILE in the past few issues I have been forced to wonder if the attention given to the minor differences caused by a slightly altered stroke-bore ratio is justified from the user's standpoint. It seems to me that Mr. Batzell has overlooked the one feature which would seem most to effect the proper stroke-bore ratio of an automobile engine. This is the question of locality.

The man who uses a town car about the streets of New York does not require the same motor as he who uses his machine for a tour through the White or Adirondack Mountains. The long-stroke motor seems to me to be one that is economical when the long stroke is being utilized but which is not economical where the reserve power contained in the motor is never called upon. It would be false economy for a man to install an engine capable of developing 40-horsepower to drive a saw which absorbs .5 horsepower yet this is practically along the same line as having a car which uses a motor which is capable of developing 40 to 50 horsepower and which runs along asphalt streets or level macadam roads with a horsepower of from 4 to 5 utilized at the road wheels.

The most economical motor is that which develops its rated power on demand and for the rated power of which there is a demand. The idea of having a single chassis to be fitted with a taxicab body or raceabout seems incongruous when the same motor is put in both chassis. If the length of the stroke could be varied in cylinders of the same manufacture having the same bore, to suit the needs of the customer to whom the car is to be delivered, it would seem that the manufacturing problem of having as few models as possible would be solved at the same time that the question of proper stroke-bore ratio was answered.

Small differences in thermal efficiency make very small changes in the owner's running expense account. In the first place, the average owner lets the car drop far below its standard of efficiency after he has had charge of it for a short period. The gathering of carbon in the cylinders, lime deposit in the radiator, loss of compression around the valve, piston rings, spark plugs and other joints all combine to lower the power output of the motor and to increase the fuel cost per mile to the consumer. Gasoline at 20 cents per gallon bring the average fuel consumption cost to less than 1.5 cents per mile. The average owner spends about $75 a year for fuel; an increase of 3 per cent. in the thermal efficiency of his engine would make a difference at the end of the year of about $12. It would take several years at this rate for him to catch up to the added price of a larger motor if this was the entire gain due to the installation of an engine made more powerful through having a longer stroke-bore ratio.

New York City. DR. ROBERT CORRY

Motor Only Hits on Three

Editor THE AUTOMOBILE:—I have a Ford runabout, 1913 model, that has a missing cylinder. The engine has been overhauled, valves ground in perfectly and new rings put in. Every cylinder gets a perfect spark, but this one will not develop any power and soon clogs up with oil.

Concord, N. C. E. K. MCCONNELL.

—The fact that you have no compression in that cylinder and that it soon gums up with oil is enough to show that the piston rings are not tight in that cylinder. There is a possibility that the piston in that cylinder is too small or that the rings are gummed up and stuck in such a position that the compression is not held and the oil easily works its way past them. The piston and connecting rods of the missing cylinder should be removed and examined and the cause of the bad compression in that cylinder will soon be learned.

If you are mistaken about the excess of oil that has gathered in the cylinder and the oil that you see is only due to the fact that it is not burned up while the motor is running the miss might be due to any number of causes. Very often when reassembling the valves after having ground them the repairman will make a bad adjustment on one of the tappets with the result that the valve will be held open. Before taking down your motor to get at the piston make sure that all the valves come down firmly on their seats and that there is clearance to the extent of the thickness of a business card between the tappet and valve stem when the valve is on its feet.

Wants Starter on Ford Car

Editor THE AUTOMOBILE:—I want a starter for my Model T. I am advised to use no starter in a Ford car. Again I am advised to use nothing but a mechanical starter. Can you give me any light on the subject?

2—My engine always stops whenever the throttle lever rests on the fifth or sixth notch. It runs well either above this or below it and will continue to run if I switch the lever across the fifth and sixth notches, but it invariably starts when the lever is stopped upon fifth or sixth.

Amelia, C. H., Va. DR. P. T. SOUTHALL.

—It would no doubt be of great convenience for a physician who is compelled to make many fresh starts during the course of a day's work to have some form of starter on his car. There are many successful types of spring starters on the market which could be applied to the Ford car and in fact some which have been designed particularly for an automobile of this make and which are very easily installed and operated. The spring type of starter which is often known as the mechanical, as the advantage of being easily applied to a car that has already been in use and which has not been designed in any way for a starter. It would be out of the question for you to put a very expensive air starter or an electric starter on your car because the expense of installation is so high that it is far out of proportion to the price of the car.

Besides the spring type of mechanical starter, there are the true mechanical starters which do not operate by springs but

are actuated from the seat by a pull on a handle located on the dash of the car, this pull is transmitted to the crankshaft or the motor and this starts it.

Outside of the mechanical starter there is the explosive or acetylene starter which might be desirable. With this type of starter there is a priming device mounted on the dash used in conjunction with an acetylene tank and a valve which permits a mixture of the acetylene and air to flow into the cylinders. The spark is then switched on and the charge of gas exploded in the cylinder that is in the firing position. This type of starter should work in every case except when the motor stops on dead center.

If you wish to put on an air starter there are types which can be applied to your car by connecting up an air pump to the motor and then fitting a distributing valve. This type of starter would also supply air for your cylinders. It would be more expensive to install on account of the fact you would have to arrange for the pump mounting and drive.

Starters of the available types are extensively advertised and with the advantages outlined above it will be a matter of choice which one you select.

2—Your carbureter adjustment is possibly such that at this point the mixture is not correct for the motor. If the carbureter works well and economically throughout the entire range of its speed except at this point it would not be worth while changing it. Should you find, however, that you were not getting good results from your carbureter, which will be evident from the fact that it would not pick up quickly enough or respond to throttle changes promptly, a change should be made. If the carbureter gets too much air at that particular speed it will cause the stopping which you have noticed. A slight change in the air valve will tell you whether this is the case or not. In making any change in the carbureter adjustments, always remember how it was before you started or you may find yourself in difficulties which will be worse than if you had left the carbureter alone altogether. In making a change start from the original adjustment and make a rather pronounced variation in one direction or the other, then start the motor and note the effects. If there had been an improvement you will know that you are working in the right direction, if not go back to the point from which you started.

There is a very good chance that the rod connecting the lever at the bottom of the steering post with the throttle on the carbureter is bent. The bend could be such that at that particular position of the throttle lever the throttle is closed. Open the hood and while some one works the throttle lever back and forth note the movements corresponding on the throttle of the carbureter. Should the carbureter be closed while the lever is in the fifth or sixth notch you will have to straighten out the bend and manipulate the rod until the changes in opening and closing correspond to the positions of the levers.

Interested in Gravity Scales

Editor THE AUTOMOBILE:—I read THE AUTOMOBILE pretty regularly, and thus get posted up in what you are doing on your side of the pond. Latterly you have written a good many articles about the fuel question, which I have read with interest, but so as to understand these articles intelligently I should like to know how the Baumé gravity scale corresponds with the specific gravity scale in universal use on this side.

We all know that the specific gravity scale is based on the fact that 1 cubic foot of distilled water at 62 degrees Fahrenheit weighs 1,000 ounces avoirdupois. Then gasoline, or petrol, or benzine, weighs, say, .72. You, however, speak of Baumé gravity of gasoline as 56-57.

Will you please give me a table showing the equivalents of specific gravity and Baumé?

Riga, Russia. A. B. LOWSON.

—Antoine Baumé, a French chemist, is the inventor of the hydrometer associated with his name. This instrument is used for determining the density of liquids. It is usually made of glass, and, in point of construction, consists of three parts:

1—The upper part, a graduated stem or fine tube of uniform diameter.

2—A bulb, or enlargement of the tube, containing air.

3—A small bulb at the bottom, containing shot or mercury which causes the instrument to float in a vertical position. The graduations are figures representing either specific gravities, or the numbers of an arbitrary scale, as in Baumé's, Twaddell's, Beck's and other hydrometers.

There is a tendency to discard all hydrometers with arbitrary scales and to use only those which read in terms of the specific gravity directly. These instruments are more commonly used for quickly determining the strength or degree of dilution of various liquids, such as gasoline, hydrometer; alcohols, alcoholometer; milk, lactometer, and acids, acidimeter.

The following is a Baumé scale and the specific gravity equivalents for liquids lighter than water:

BAUMÉ°	SPECIFIC GRAVITY	POUNDS IN GALLON	BAUMÉ°	SPECIFIC GRAVITY	POUNDS IN GALLON	BAUMÉ°	SPECIFIC GRAVITY	POUNDS IN GALLON
10	1.0000	8.33	37	0.8383	6.99	64	0.7216	6.03
11	0.9929	8.27	38	0.8333	6.95	65	0.7179	6.00
12	0.9859	8.21	39	0.8284	6.91	66	0.7142	5.97
13	0.9790	8.16	40	0.8235	6.87	67	0.7106	5.94
14	0.9722	8.10	41	0.8187	6.83	68	0.7070	5.91
15	0.9655	8.05	42	0.8139	6.80	69	0.7035	5.88
16	0.9589	7.99	43	0.8092	6.76	70	0.7000	5.85
17	0.9523	7.94	44	0.8045	6.72	71	0.6965	5.82
18	0.9459	7.88	45	0.8000	6.68	72	0.6930	5.79
19	0.9395	7.83	46	0.7954	6.64	73	0.6896	5.77
20	0.9333	7.78	47	0.7909	6.60	74	0.6863	5.74
21	0.9271	7.73	48	0.7865	6.57	75	0.6829	5.71
22	0.9210	7.68	49	0.7821	6.53	76	0.6796	5.68
23	0.9150	7.63	50	0.7777	6.49	77	0.6763	5.65
24	0.9090	7.58	51	0.7734	6.46	78	0.6730	5.63
25	0.9032	7.54	52	0.7692	6.42	79	0.6698	5.60
26	0.8974	7.49	53	0.7650	6.39	80	0.6666	5.57
27	0.8917	7.44	54	0.7608	6.36	81	0.6635	5.55
28	0.8860	7.39	55	0.7567	6.32	82	0.6604	5.51
29	0.8805	7.34	56	0.7526	6.29	83	0.6573	5.48
30	0.8750	7.29	57	0.7486	6.26	84	0.6542	5.45
31	0.8695	7.25	58	0.7446	6.22	85	0.6511	5.42
32	0.8641	7.21	59	0.7407	6.19	86	0.6481	5.40
33	0.8588	7.16	60	0.7368	6.16	87	0.6451	6.38
34	0.8536	7.12	61	0.7329	6.13	88	0.6422	5.36
35	0.8484	7.07	62	0.7290	6.10	89	0.6392	5.33
36	0.8433	7.03	63	0.7253	6.07	90	0.6363	5.30

$$\text{At } 60^\circ \text{ F., Sp. Gr.} = \frac{140}{130 + {}^\circ\text{Bé}}$$

Wants to Become a Racing Driver

Editor THE AUTOMOBILE:—1—Where can one learn to become, or get the experience to be classed as, a racing driver?

2—Do racing drivers teach young men the racing business?

3—Where can a person apply for a place to learn the business?

4—Do racing drivers furnish their own cars?

5—How did most of the prominent drivers enter the game?

6—Are most of the drivers college men or did they have a special mechanical training?

Buffalo, N. Y. W. L. A.

1—Many of the successful racing drivers gained their experience while working as testers for automobile factories. The remainder gained their experience by various means, one of the principal ones being through driving their own cars. After having by some means learned how to drive a car well enough to hold it on the road when traveling continuously at a high rate of speed, the next step is to convince some one who is entering a car in a race that you are the man to drive the car. This is often the stumbling block in the way of the prospective racing driver. Many racing drivers of means have entered their own cars and of course this simplifies the matter of getting a job to a remarkable degree. It would hardly be advisable to go into an automobile factory as a tester with the idea of using this opportunity of learning how to drive racing cars, as automobile factories do not look with favor on testers who unnecessarily run the car at high speed to the exclusion of other more important features of the testing work. If you care to

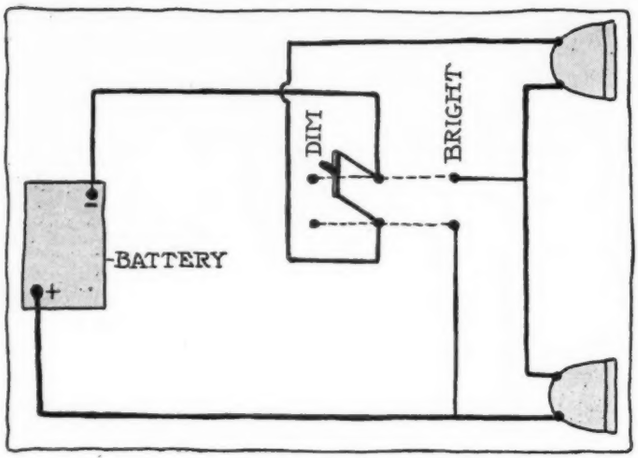


Fig. 1—Suggested wiring diagram to use dim or bright headlights

secure such a position, however, to gain the experience in driving with a possible chance of acquiring skill enough to get into the ranks of those who could drive a racing car if they had the chance it would be as good a method as any.

2—There can be no doubt but that for a remuneration any racing driver would be glad to instruct you in his business.

3—This question is answered under No. 1.

4—Those who have no connection with a factory or who have sufficient means to take their choice in the car they wish to enter often furnish their own cars.

5—Many gained their preliminary experience acting as factory testers.

6—Most of the drivers are not college men, they have all had practical mechanical training.

Wiring Diagram Shown Incorrectly

Editor THE AUTOMOBILE:—The wiring device shown in pages 244 and 245 of THE AUTOMOBILE, August 7, to allow switching from bright to dim lights is wrong. One light will burn brightly all the time, the other will go out when the dim switch is thrown. The potential between the connections of one light remains the same while that of the other is 6 volts or nothing, not 3 volts as stated. Would suggest wiring as per Fig. 1.

Cincinnati, O. GEORGE N. SIMPSON.

—In the wiring diagram shown in THE AUTOMOBILE August 7 the secondary switch which must be opened when the dim line is closed was omitted. The corrected diagram is shown in Fig. 3. As will be readily understood the scheme would not work unless some such switch were used. When this switch is open and the dim switch closed it will be seen that the lamps are in series and that the voltage of six is divided between them into three for each lamp. The double throw switch suggested by Mr. Simpson combines the functions of the dimming switch with that of the supplementary switch and would make a simpler form of wiring.

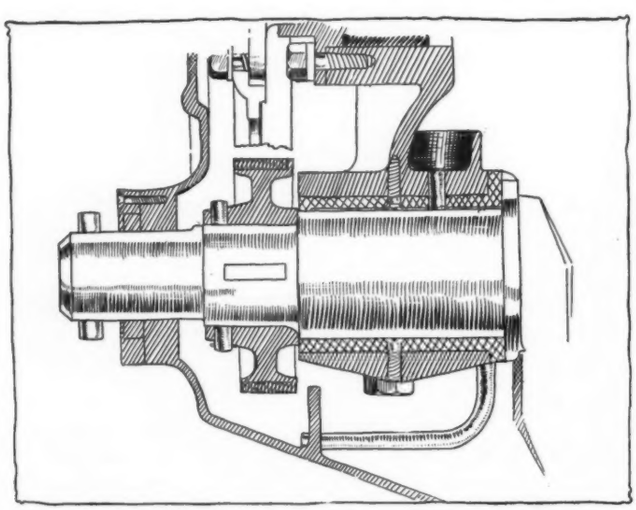


Fig. 2—Form of bearing used at forward end of crankshaft

Has Knock Near Flywheel

Editor THE AUTOMOBILE:—I have a Studebaker 20 (Flanders) 1911 model and ever since I had the car overhauled last winter I have had a slight knock in the car which is a little louder when the car is going up grade than when the engine is running free. I have had it in the garage several times and they have taken up the connecting rods, etc., but have not stopped the knock. After testing all the bearings myself I have located same at the flywheel. While I cannot find any looseness at this point, still I am quite sure that this is where the trouble is. Will you kindly advise how this knock might occur at this point and the remedy for same?

Watertown, N. Y. SUBSCRIBER.

—The knock is probably in the main bearing next to the flywheel. The reason that this looseness in the bearing has not been found is in all probabilities due to the fact that the weight of the flywheel has made the bearing seemed tight whereas in reality there has been some play at this point. Often you will take up a bearing and know that though you have turned up the bolts as far as they will go the bearing will still be loose. In this case the steel part of the bearing will have to be filed away in order that the lining can be drawn up tighter. The parts to be filed, it must be understood, are the bearing flanges. The metal is taken away gradually until the fit of the bearing is correct. If it is too tight it will bind the crankshaft and shims will have to be fitted in order to again secure looseness. Probably you will only have to file off metal to the extent of the thickness of a piece of paper. The bearing at this end of the motor has considerable weight to carry and often becomes loose if it is not made long enough. The illustration at Fig. 4 shows the general construction back of the flywheel and will be seen that it is necessary to have a long bearing at this point. The bearing at the forward end is entirely different in this respect and has to support practically nothing but the crankshaft and timing gear as will be seen from Fig. 2.

Oil Won't Leak on Grade

Editor THE AUTOMOBILE:—What angle of declination can a car be stopped on a hill either sideways or fore and aft without oil running out of the crankcase filled and wasting. I have reference more particularly to the Rutenber motor. I don't know that I have been bothered with any wasting in this way, but would like to have the matter settled for my satisfaction.

Brewton, Ala. E. M. BLACKSHER.

—The chances of oil escaping from the crankcase of a motor by any such reason as the car standing on a gradient is practically impossible. Even on a 30-degree slope the oil would still, in most motors, be some distance from the point at which it would leak to any extent because the only means of escape it would have would be through the rear main bearing and that would be only a drip. In many engines the lower part of the crankcase is cut off from the upper part by a horizontal tray which forms a partition. The only holes through this partition are between the oil troughs which are carried in the tray. The car would have to be tilted until the oil lever rose above one of these holes. This slope would probably be so severe that the car would slide down the hill with the wheels locked. In other words, although there is a possibility of the back of the crankcase being flooded when the oil reservoir is too full there is hardly any chance for any leakage below a 30-degree slope. Above that it would be a question of the design of the particular motor considered. The crankcase on a motor always becomes deeper toward the rear on account of the slope on the bottom and thus the depth in the

back of the crankcase is not increased so rapidly with the increase slope of the car as if the bottom of the crankcase pan were level and parallel with the ground. You can readily determine for yourself the amount of slope necessary because of a leakage in your particular motor by laying a straight edge along the crankcase parallel and even to the oil level when full. Swing the straight edge about the point corresponding to the forward end of the oil surface until the line of the straight edge passes through the plane of the bottom of the crankshaft, the angle passed through will give the number of degrees that the car must slope before the oil will cover the rear main bearing. This is the first point of leakage and you will find that the slope necessary to cause this will be very severe. The next higher point of leakage is around the valve tappets of the rear cylinder and the slope necessary to attain this point would be impossible. Of course in a great many splash-lubricated cars it cannot be denied that there is a marked tendency for the oil to be collected in the rear of the crankcase and often some of the excess will be thrown from the crankcase around the push rod bushings.

From Indianapolis to Chattanooga

Editor THE AUTOMOBILE:—Will you kindly give me the best route from Indianapolis, Ind., to Chattanooga, Tenn.; also about what is the distance? MAC CARPER.

Winamac, Ind.

—The best route to take from Indianapolis, Ind., to Chattanooga would be by way of Louisville and Nashville. The route from Indianapolis to Louisville, Ky., has recently been improved and is not bad. It covers 124.2 miles going by way of Seymour, Crothersville, Scottsburg, Henryville, New Albany and Louisville. From Louisville to Nashvile is a run of 225.4 mies through roads which vary all the way from fair to very rough and rocky. As it is the only way through, however, you will have to take what you find along this part of the route. You pass through Beuchel, Fern Creek, Mt. Washington, Bardstown, Balltown, New Haven, Buffalo, Pikeview (along this stretch of road you can expect almost any variety of sharp rock), Canmer, Hardyville, Bear Wallow, Cave City, Good Night (probably refers to roads), Glasgow, Bruce, Cedar Springs, Scottsville, Cedar Grove, A. B. C., Bransford, Gallatin and Nashville. From Nashville to Chattanooga is 143.1 miles passing through Murfreesboro, Beach Grove, Manchester, Hillsboro, Pelham, Assembly College, Tracy City, Sequatchie, Jasper Rankins Ferry and Chattanooga.

Road Man Likes Accessibility

Editor THE AUTOMOBILE:—About the best thing I have seen in THE AUTOMOBILE is your editorial on the accessible car. I am what is known in the trade as a road man. That is, I am a traveling mechanic for an automobile company and have been in the business for 10 years and when I say that cars are getting worse every year, that is as far as accessibility is concerned, I think I know what I am talking about. What I would like to see would be a large kettle erected on some suitable spot, say Belle Isle, then have it filled with some of the cheap oils now on the market, build a good fire under it with some more of the same oils and when it has reached the boiling point drop the present crop of engineers into it one by one. As spectators at this interesting spectacle I would have all embryo engineers that could be found. They would be warned that they would suffer a like fate, or even worse, that is, banished to Windsor, if they made the same mistake of their predecessors and did not study

Please Sign Your Inquiries

The Editor of the Rostrum is in receipt of several letters which offer no clue to the identity of the sender because they are signed Subscriber, Reader, by initials or noms de plume. These letters are held and will be published as soon as the senders identify them. If your letter is among these you can have it published by writing this office describing the letter.

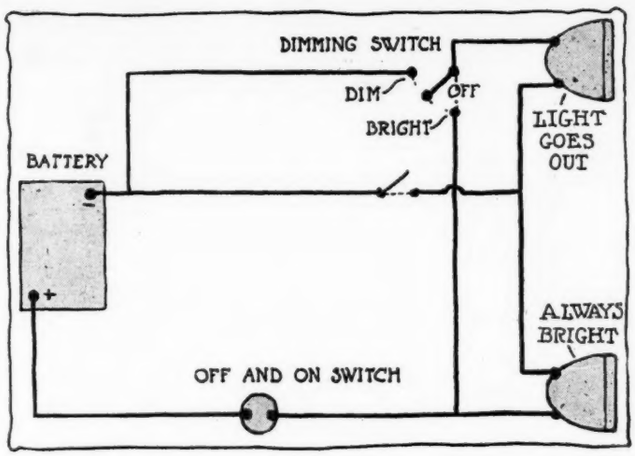


Fig. 3—Corrected wiring diagram to dim headlights with secondary switch

accessibility. The car owners who have paid a $20 repair bill for replacement of a $2 part would also be invited guests and I am sure they would enjoy it even if the engineers did not. It should particularly appeal to them.

Do not think for a minute that you can tell an engineer where he can improve his work. No sir. I was in the experimental room one day and overheard the foreman, who is as clever a mechanic as ever lived, attempt to explain to the engineer how a slight change in a forging would mean a saving of at least 2 hours in assembling. The engineer walked away and the thing went through as originally planned.

The car that I am working on now is equipped with an electric cranking and lighting system.

On such a system, outside of the battery, there is one point which needs constant attention and adjustment, and this is the starting switch. This is located underneath the clutch and foot brake pedals and a few inches above the sod pan. It is right in line to catch all the oil, dust, etc., blown back by the flywheel and it is almost impossible to take it off without first taking off the sod pan. By the addition of a few inches to the front of the starting shaft this switch could be located so that to get at it all you would have to do is raise the hood.

This is only one of many; therefore I say, "boil 'em."

Philadelphia, Pa. H. P. R.

(Although H.P.R., who is a professional, may seem a little hard on the engineers some car owners may have a little to say on this subject.—Editor.)

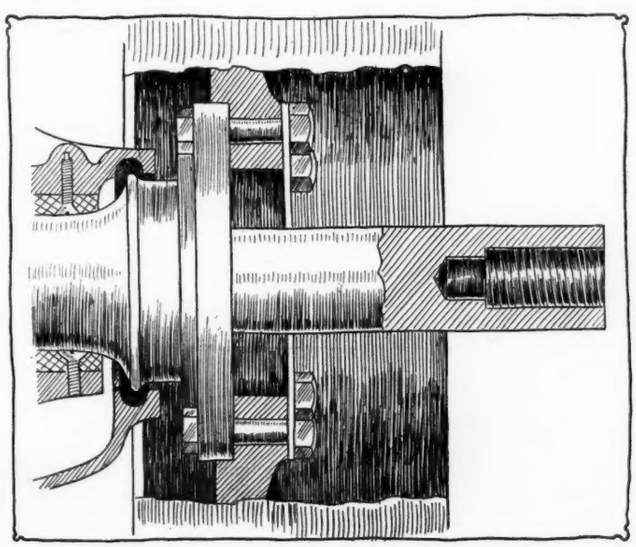


Fig. 4—Form of bearing used at flywheel end of crankshaft

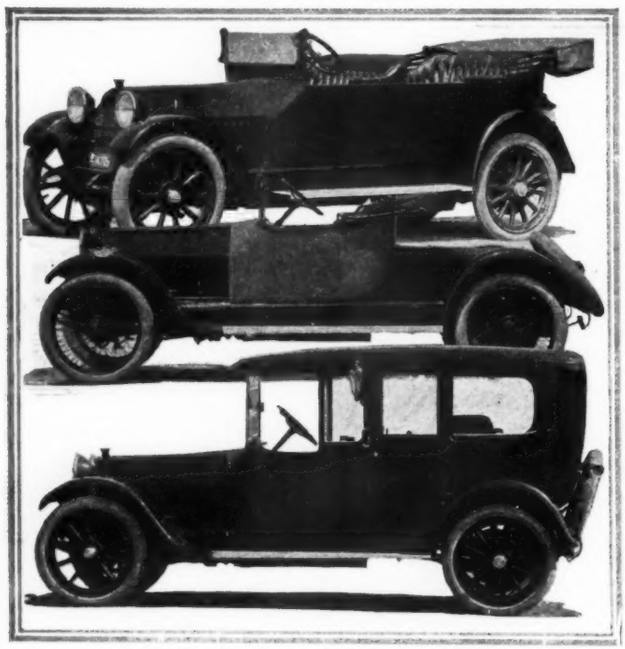


Fig. 1—Three body types seen at a glance—touring, roadster and limousine

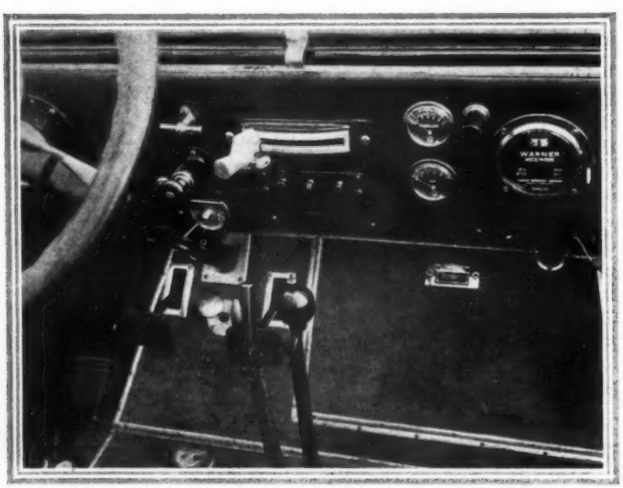


Fig. 2—Left side of dash, showing arrangement of control features

New Chalmers Six for 1914

Air Starters Superseded by Electric—T-Head Motor Another Innovation—Uses Left Drive

THERE is an entirely new Chalmers six for next year—model 24. The motor is quite new, differing greatly from all previous Chalmers designs. It uses T-head cylinders, has an electric starter, possesses a new forced-feed oiling system, and has inclosed valve parts. The gearset is still a unit with the motor. The multiple-disk clutch has cork inserts in one set of disks. There is a new torsion rod design, rear springs are underslung, the steering wheel has been put on the left side for the first time in a Chalmers model, with the levers in the center; the gasoline tank is now carried at the rear for the first time and pressure feed is used; the spare rims or wheels are carried in the rear; and lastly, but by no means least, there is an entire new body design with a host of meritorious features incorporated in it. In a word, model 24 must be looked upon as a brand new Chalmers product to take the place of the 1913 six.

Compared with the present Chalmers six it has a slightly smaller motor, a wheelbase 2 inches longer and lists at $225 less in roadster and four and five-passenger models; $325 less in the six-passenger types; $100 less as a limousine; and $50 more as a coupé. The new models are completely equipped in all body types. The new Chalmers-Entz combined electric-starting and lighting system supersedes the air starting system on the 1913 model; single Bosch ignition takes the place of the previous dual type; and numerous other minor changes will be referred to later.

Introduces T-Head Motor

The new motor is one of the major features of model 24. It marks the debut of this company in the T-head field, having previously used a cylinder casting with the intake valve in the head. Now the exhausts are at the right, the intakes opposite and with the inclosed valve operating parts a very quiet motor has been obtained.

The cylinders in groups of threes are very clean-cut castings

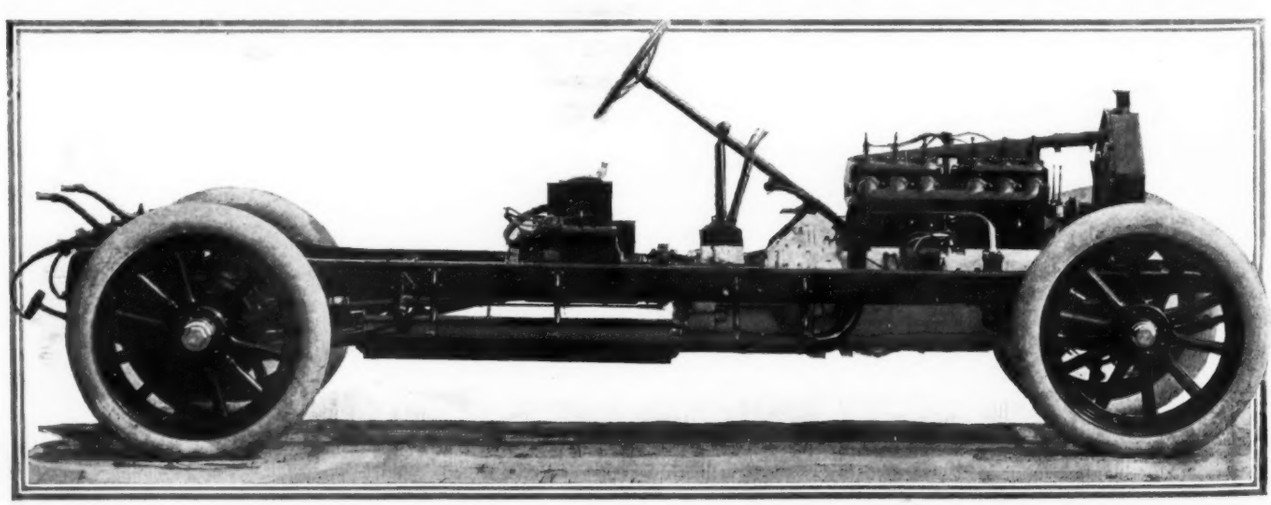


Fig. 3—Side view of chassis; note long low-hung frame with rear spring dropped below the rear axle

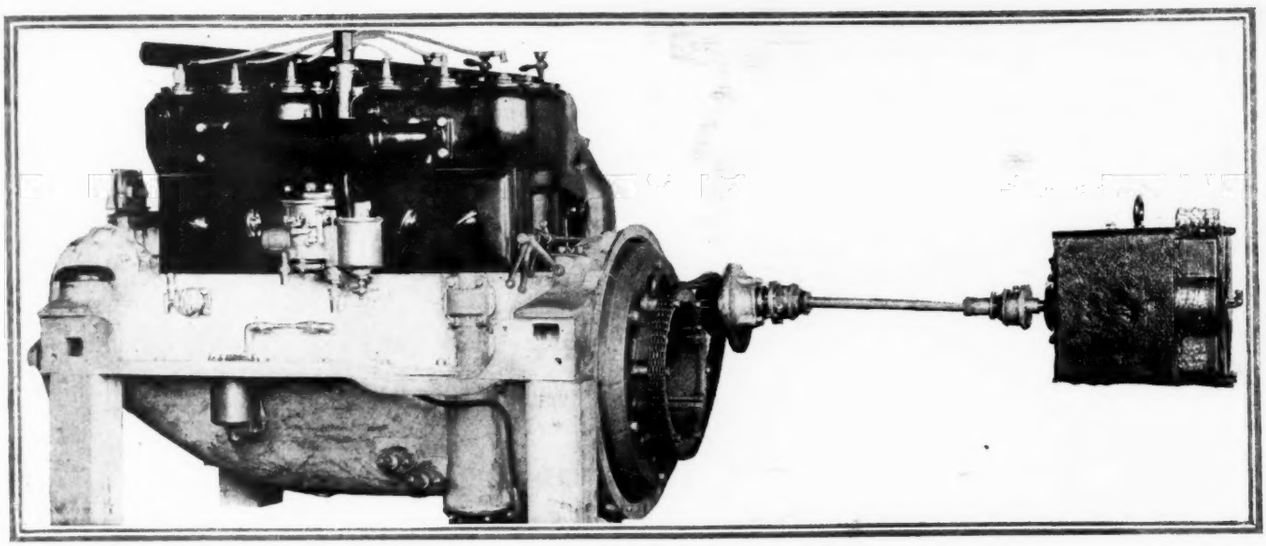


Fig. 4—Intake side of motor and method of mounting the combined lighting and starting unit

with good waterjacket spaces not only around the cylinders but also around the valve seats and partly surrounding the valve stem guides. The jacket heads are formed integrally with the water header, or return pipe to the radiator, and in the head of the combustion chamber is a 2⅜-inch threaded plug which when removed gives access to the entire combustion chamber for carbon removal without removing the cylinder castings. The water enters the rear face of each cylinder group, this being the hottest part.

The cylinder dimensions, bore 4 inches, stroke 5.5 inches, gives an S.A.E. rating of 38.4 horsepower, a piston displacement of 414.7 cubic inches and a stroke-bore ratio of 1.333 to 1.

These are smaller than in the 1913 six which is 4.25 by 5.25, 43.85 horsepower, 446.7 cubic inches and a ratio of 1.23 to 1.

The new 24 shows a stronger inclination to the long-stroke design as well as following the general tendency in having a smaller piston displacement, giving a more economical motor with a greater horsepower output per unit of piston displacement.

More power has been obtained with lighter reciprocating parts, better materials and better cylinder castings. The connecting rods are 40 per cent. lighter than in 1913. They are nickel steel instead of open hearth, and are made with a thinner section. At the lower ends there are but two bolts securing the cap instead of four.

Lighter Pistons with Special Rings Used

The pistons are lighter in spite of the fact that they are longer than formerly, which has been necessitated by the longer stroke used. They are better castings and carry four section-type rings. Each slot carries a complete outer ring, but inside of it is a series of arc-shaped segments forming an inner ring, with each segment pressed outwardly by a small leaf spring, used to assure even pressure of the outer ring against the cylinder wall. The constant pressure obtained by this construction of piston ring results in good compression being maintained for a longer period than is possible with the older type.

The crankshaft, a Wayman & Gordon forging, 40 per cent. carbon, has curved cheeks which bring their weight into the center of the shaft axis, thereby assisting in giving a good rotary balance, a design brought out 2 years ago and one that is coming

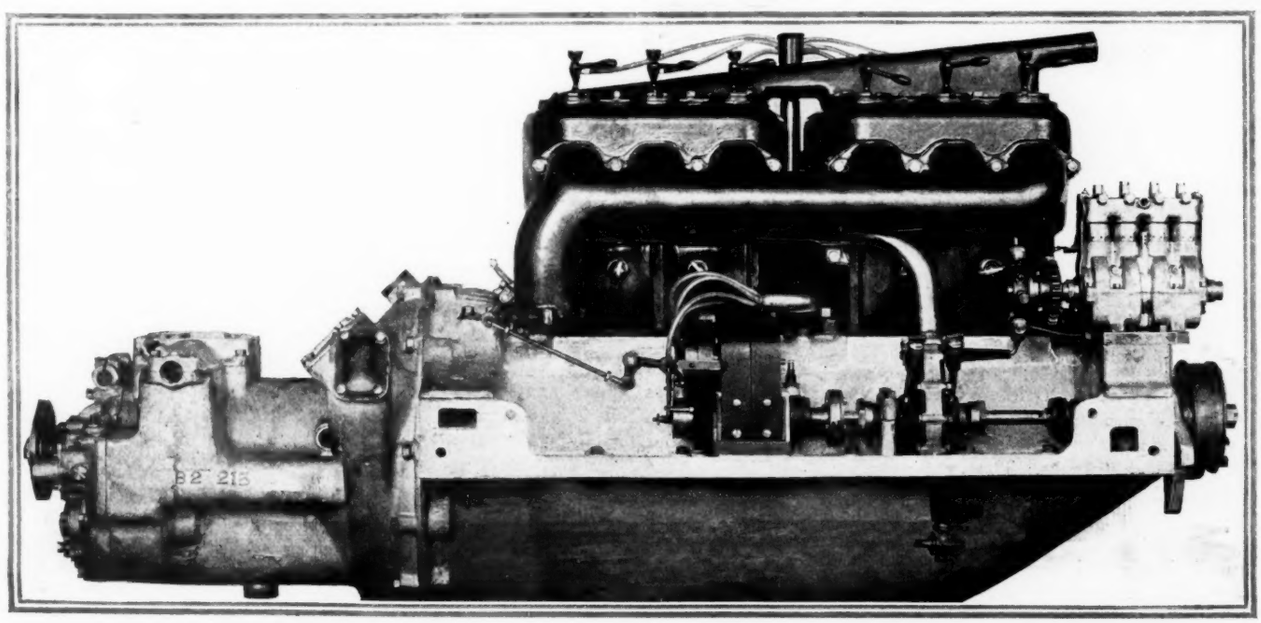


Fig. 5—Magneto and exhaust side of motor. Note mounting of air pump and bridged water outlet manifold

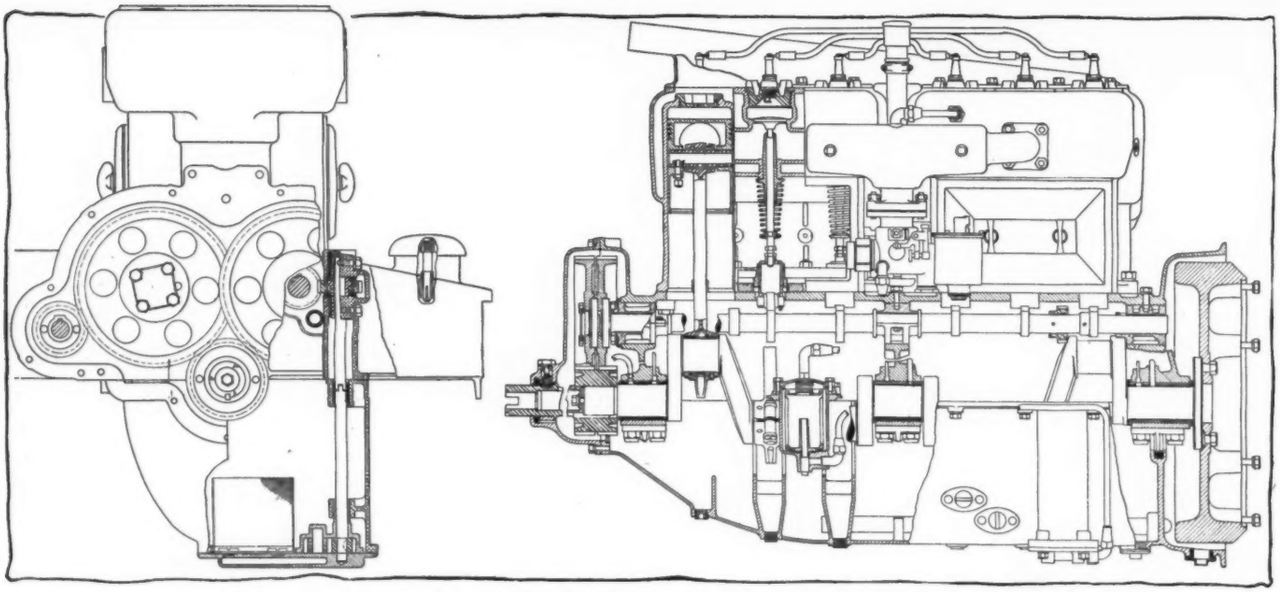


Fig. 6—Part sectional end and side views of motor used in the 1914 Chalmers six, showing force-feed oiling

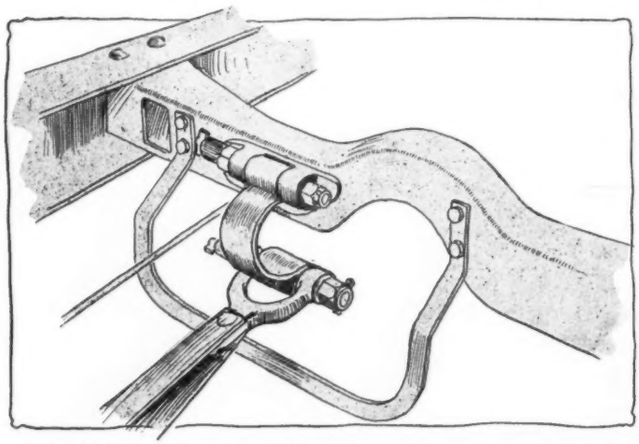


Fig. 7—New connection designed for the attachment of torque member

into use. The shaft is carried on three plain bearings of bronze with a babbitt lining, 2 1-8 inches in diameter.

A motor improvement, and one that is coming in for much attention throughout the country, consists in using tungsten steel intake and exhaust valves, which are described as being proof against pitting. This type of valve is being used quite generally in racing cars with commendable results. The valves, both sets, are 2⅛ inches in diameter, have 7/16-inch lift and 85-pound pressure springs are used on both sets.

In the new oiling system a gear pump in the crankcase sump delivers to a large-diameter pipe extending from end to end of the crankcase and carried inside of it. From this pipe are three branches to the crankshaft bearings. The overflow oil from these bearings instead of dropping into the sump is led out of the opposite end of the bearing from which it enters through a short pipe and drops into little trays integral with the sides of the crankcase base and from these trays it flows into the oil troughs beneath the connecting rods. The connecting-rod scoops dip into these troughs. The final overflow from the troughs falls into the sump for re-circulation.

An improved form of accessible oil strainer is mounted on the left side of the crankcase in the web between the front and rear legs. It is a cup-shaped casting 3 inches in diameter and about 5 inches high. Inside it is a readily removable screen forming a loose lining for the cup. The oil enters from the base at A, Fig. 8, passes outwards through the gauze, escaping by exit E. Should for any reason the screen become clogged then the inner cover C_1 is lifted by the pump pressure overcoming the spring over the cover, thus permitting the oil to flow over the top of the screen to the exit. The upper cover C is readily removable. Mounting this strainer in so accessible a position is assuranec that it will receive attention. Timing gears are oiled direct from the overflow of the front bearing by means of a short pipe which pours the oil onto the pinion on the crankshaft.

Chalmers-Entz Starting System

The Chalmers-Entz combined electric motor and generator for cranking the gasoline motor and also charging the storage battery is one of the neatest jobs of its kind on the market. The motor-generator instead of being mounted alongside the motor is located under the right front seat and is driven by a short propeller shaft extending forward to the near rim of the flywheel where it carries a small sprocket driven by silent chain from a large sprocket on the flywheel. This is a novel drive for a self-starter unit, but it is positive and entirely inclosed.

The motor-generator will spin the gasoline motor at 100 revolutions per minute and in starting it is but necessary to move a small switch on the dash. As a generator for delivering current to the storage battery it being charging at car speeds of 7 to 8 miles per hour and reaches its maximum charging rate at 18 or 20 miles per hour when the rate of charge is 15 amperes. The motor-generator is geared 2.6 to 1.

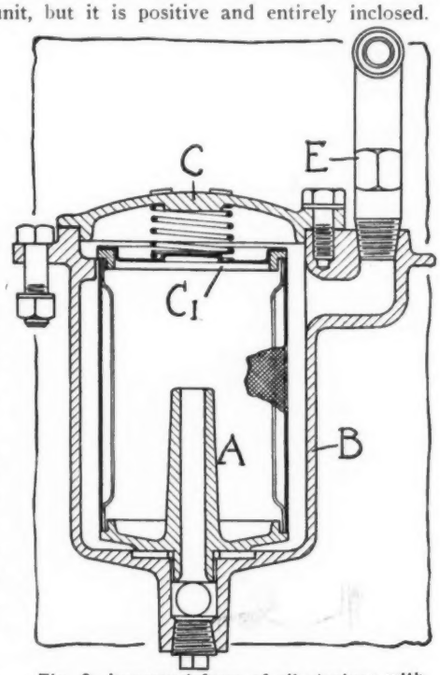


Fig. 8—Improved form of oil strainer with removable gauze strainer

This motor-generator is made en-

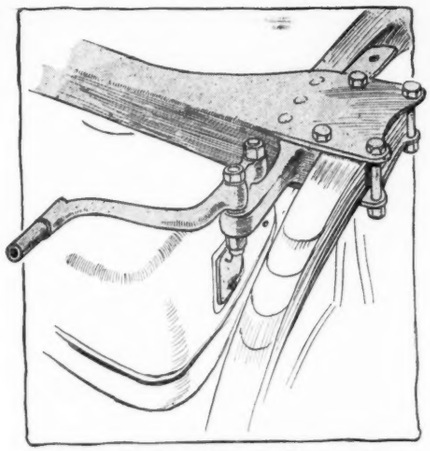


Fig. 9—Rear spring and tire carrier attachment

tirely in the Chalmers factory and is an 18-volt system. The complete unit approximates 230 pounds in weight, 100 pounds for the motor-generator, 100 pounds for the battery and 30 for the driving parts and attaching brackets. The motor-generator is located on a neat pressed steel bracket from the frame side member and on the opposite side of the frame is a similar bracket supporting the battery, giving an evenly balanced distribution of the weight on the chassis.

Clutch Oiled from Motor

The multiple-disk clutch has been improved by inserting cork inserts in one set of disks and operating the entire clutch in oil.

A torque rod improvement consists in supporting it at the forward end through a curved leaf vanadium steel spring, which leaf while offering the same freedom of movement of the previous support does so at a saving of 25 pounds in weight.

The front axle has a double tilt at the steering parts. There is a backward tilt of from 1.5 to 2 degrees and the knuckle pins point slightly outward.

The frame is heavier than formerly, being of stock 1/16 inch thicker. The side members are dropped in advance of the back axle, but are not inswept at the dash. Front springs measure 39 inches with 2-inch leaves; and the three-quarter rears are mounted under the axle not because this mounting affords any lower body suspension but rather that it gives approximately double the radius of spring movement. The top leaf is of vanadium steel. The measurement is 52 inches with 2¼-inch leaves.

Brakes are much as this year, being internal and external rear wheel sets. The external or service ones act on drums 16⅜ inches in diameter and 2¼ inches wide. The internal emergencies operate on drums 16 by 2 inches. Both are asbestos faced and work through equalizers.

It is in connection with the bodies that almost countless changes have been made, the bodies being stream-line designs in which the hood is widened and heightened as it converges into the cowl, where the transition into the body has been all the more accomplished by leaving off dash lights and using a combination headlight which has double bulbs, 24-candlepower ones for headlight purposes and 6-candlepower ones mounted above the lens exits for use instead of dash lights.

Many anti-noise features have been introduced, the most noteworthy being the rubber buffer inserted in the door jamb, Fig. 11. The connection at the base of the door for the circuit operating the electric horn is shown in Fig. 12. The door hinges are entirely inclosed, Fig. 13.

The model 24 chassis is made in one wheelbase length and to this is fitted seven body styles all interchangeable and all carried on eight small stamped brackets carried on the outside of the frame side members, four to the side. This mounting is aimed to eliminate body squeaks and also to give a quick demountable feature.

The roadster and four and five-passenger bodies list at $2,175, the six-passenger at $2,275, coupé $2,850, and limousine $3,600. With McCue wire wheels $80 is added. There is one other option, namely, Kellog tire pump, an extra rim casing and tube and tire cover, $75. The regular list includes mohair top, rain vision windshield, demountable rims, speedometer, rear tire carrier with extra rim, electric horn, electric starter, electric lighting, etc. Tires are 36 by 4½ all around.

The standard colors for open cars are Brewster green, grey and meteor blue; for closed cars, valentine coach blue.

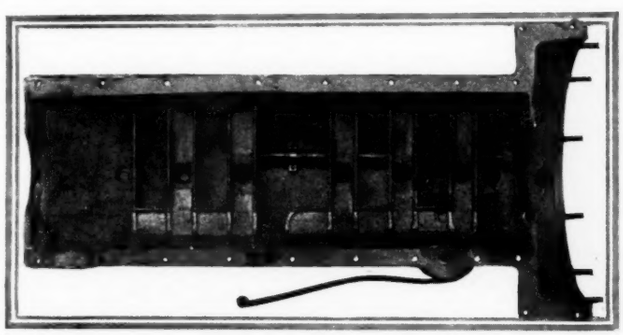
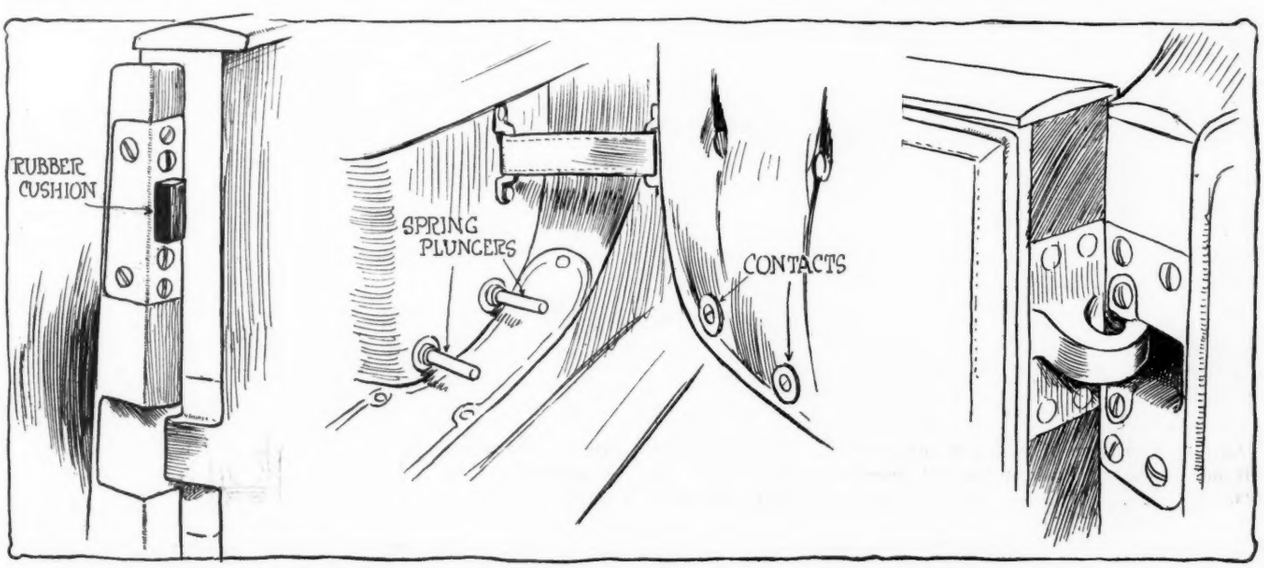
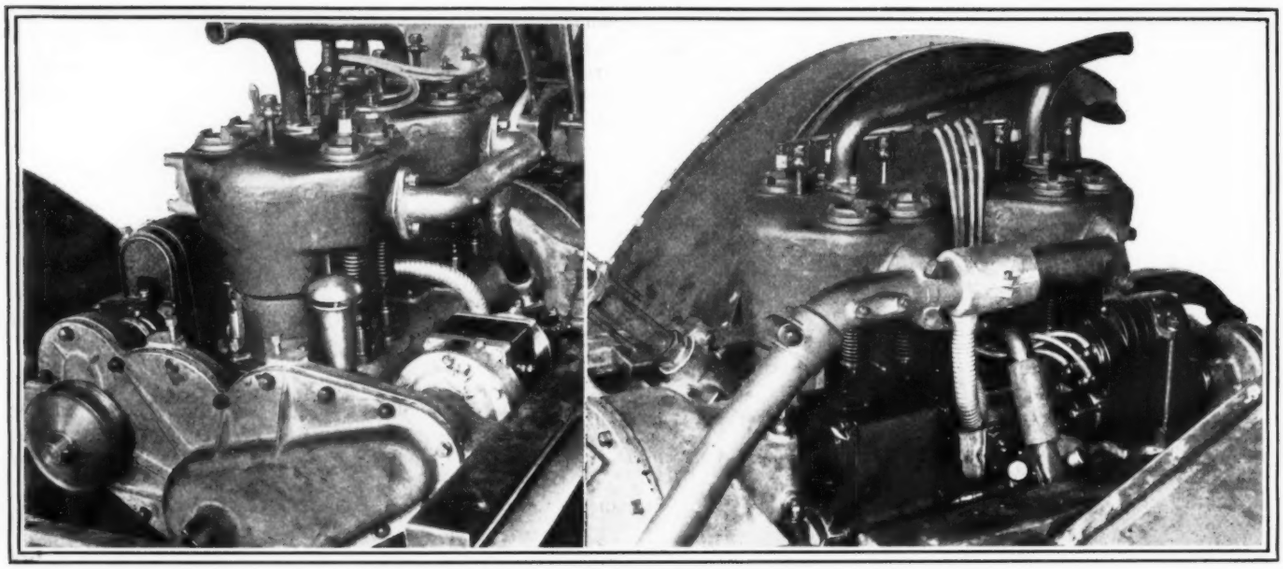


Fig. 10—Form of crankcase used in connection with new force-feed oiling



Figs. 11, 12, 13—Anti-rattling feature, electrical connectors for horn and concealed hinges on the door of the 1914 Chalmers



Left side of Case Model 25 motor, showing starting motor and extension of front cover for chain to crankshaft

Right side of Case 25 motor, showing generator, water pump and connection for hot water jacket of carbureter

Two New Four-Cylinders in Case Line

Smaller Develops 34 Brake Horsepower, While Larger Develops 46—Three-Bearing Crankshaft Used in Both

TWO four-cylinder cars, models 25 and 35 of practically the same design and listing at $1,250 and $1,850 respectively with full equipment comprise the new offering of the J. I. Case Threshing Machine Co., Racine, Wis., for 1914. The line includes another car, the 40, which was marketed this year, but for 1914 is to be seen with a number of improvements, selling for $2,300 instead of $2,200 for the passenger-five. The Case 30, of 1913, has been discontinued.

The feature of the entire line for the coming year is the equipment. At the prices above mentioned, will be given a Westinghouse cranking and lighting system, Warner speedometer, 8-day clock, electric vibrator horn, extra tire on a rim, two extra inner tubes, tire cover, Weed chains, top, windshield, spark-plug pump, work lamp and a full set of lights. Most of this equipment appeared on the Case 40 in 1913, the exceptions being the spark-plug pump and clock. On this car a Pantasote top has been substituted for the mohair used last year.

The 25, the smallest car of the line, has a 110-inch wheelbase. The clean running boards on this and the other models add much to the appearance of the cars, obtained by placing the battery box under the rear foot boards. The battery on the 25 is a Willard of 80-ampere-hour capacity.

T-Head Construction Used

The 25 motor is part of the unit power plant and is of T-head construction, cast in pairs, with a bore and stroke of 3.75 by 4.75 inches, developing about 34 horsepower according to factory brake tests. The valve heads are of nickel-steel and the stems of carbon-steel, the diameter of all valves being 1 7-8 inches. The lift is 9-32 inch. Cover plates are provided for both sets of valves, the covers fastening to ribs on the cylinder casting.

The crankshaft is carried on three babbitt bearings, the dimensions of the front being 1 5-8 by 2 5-8 inches, the center, 1 5-8 by 2 1-2 and the rear 1 5-8 by 3-34 inches. The lower connecting rod bearing is babbitt with a bronze back and measures 1 5-8 and 2 1-4 inches.

Bosch duplex ignition and a non-waterjacketed Rayfield carbureter of 1-inch diameter is used. The magneto is located on the right side of the motor and operated by a shaft parallel to and above the water pump shaft. The carbureter is on the opposite side and is fed by gravity from a 15-gallon tank.

Oiling System Holds 1.5 Gallons

The oiling system contains 1.5 gallons of lubricant, and consists of a brass plunger pump, within the aluminum crankcase, with an auxiliary splash. The pump forces oil to a sight feed and then to the front end gears of the motor, the overflow running to troughs, one under each connecting rod. The overflow from these drops to a sump and from there the oil is carried through strainers back to the pump.

The motor timing gears are of the helical type, made of cast iron, and are of 10 pitch. The camshaft is 7-8 inch diameter and operates on three plain bearings. Cooling is by a centrifugal pump, located on the right side of the motor, the capacity of the cooling system being 4 gallons.

A feature of the 25 power plant is the Westinghouse starting and lighting installation. This is of the three-unit type comprising a generator and motor. The generator is on the right side of the motor and is operated by an extension of the pump shaft. The generator supplies current for the motor, which is on the opposite side and drives directly to the crankshaft by sprockets and chain. An overrunning clutch is provided on the crankshaft sprocket, which makes the starting motor inoperative when the gas engine is firing. The entire engine weighs about 550 pounds.

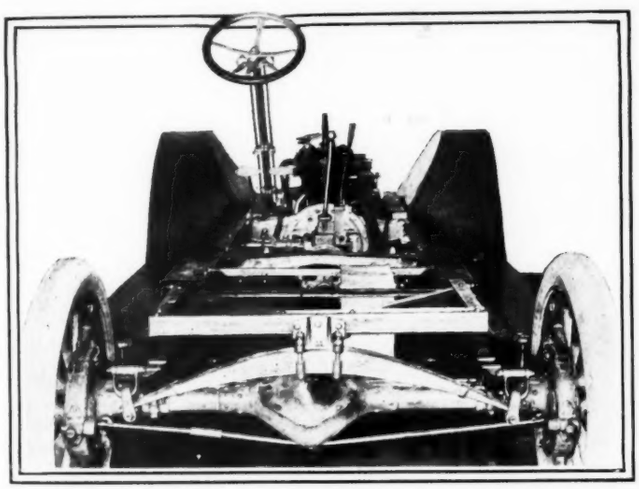
From the motor the drive is through a disk clutch, steel against steel plates and operating on ball and roller bearings. From here the power is transmitted to the gearset directly to the rear. This is a Brown-Lipe product and has three forward

speeds and reverse and operates on Hyatt bearings. The gears are of nickel-steel, case-hardened. The control lever for the gearset is of the ball type, having a short throw, is located in the center of the chassis and is on a separate platform from the hand brake.

The drive shaft is of 1 1-4-inch diameter and is inclosed in a torsion tube, supplied with a ball joint at the forward end. The rear end of course, is rigidly fastened to the rear axle housing. The drive shaft bearings in the torsion tube are Hyatt ball bearings. One Spicer universal is used in the drive.

Weston-Mott has supplied the rear axle for the 25 Case. This is of the three-quarters floating type, operating on Hyatt and New Departure bearings and inclosed in a malleable iron housing. The axle shafts are of nickel-steel. Both front and rear wheels operate on New Departure bearings.

The steering wheel is of the nut and screw type, supplied by the Jackson-Church-Wilcox Co. and is on the left side of the chassis. Two sets of 12-inch brakes, without equalizers, are provided, both being faced with non-burning material. The



Rear chassis view of the Case Model 25, showing the left drive, center control, platform suspension and battery box location

rear spring suspension is of the platform type, the crosspiece being linked freely to the semi-elliptic side members.

The frame is 5-32 by 4-inch channel section with a kick-up in the rear. The weight of the entire car, equipped fully is given as 2,500 pounds. Facilities for carrying extra tires are in the rear of the chassis as the illustration on this page shows. Tires are the same size all around, being 32 by 4-inch Goodyear on Q. D. rims.

At $1,250 the Case 25 will be marketed in five-passenger touring form. The body is of sheet steel and incorporates the new ideas brought out by manufacturers for the coming season. The cowl board holds the ignition switch, sight feed, clock, speedometer, and lighting switch, and is something new in Case body construction. The cowl board is characteristic of all 1914 Case cars.

Unit Power Plant Used in 35

The 35 differs in many respects from the 25 just described. Here the unit power plant is used, the motor being of four-cylinders, of T-head construction, cast in pairs. The bore and stroke is 4.25 by 5.5, developing 46 brake horsepower at 1,700 revolutions per minute. The crankshaft is carried on three babbitt bearings, the dimensions being as follows: front, 1 7-8 by 3 inches, center, 1 7-8 by 3 and rear, 1 7-8 by 4 inches. The lower connecting-rod bearing is babbitt with bronze back and is 1 7-8 by 2 7-8 inches.

The valve material and construction is the same as that of the 25, the lift in this case being 5-16 inch. The oiling system is the same as the smaller model, but instead of using a plunger pump, a gear pump is used, located in the crankcase, as before. Bosch dual ignition is used and a waterjacketed Rayfield carbureter of 1.25-inch diameter. The location of these and other parts is the same as in the 25. The capacity of the water system is 5 gallons and of the oiling system 1.75 gallons. In other respects the two motors are the same.

The clutch is of the disk type with plates of steel against raybestos, and supplied with a brake to prevent spinning. The drive from this unit is to a Brown-Lipe three-speed selective gearset, which is part of the unit power plant. Shafts are carried on Timken bearings. The propulsion means differs from the 25, in that a V-shaped torque member is used instead of the tube. Another point of difference is to be noticed in the floating rear axle.

Three-Quarter Elliptic Rear Springs on 35

Two sets of brakes of 14 inches diameter are provided, the foot brake being supplied with equalizers. Both front and rear wheel bearings are of the ball type, all wheels carrying 35 by 4 1-2-inch tires, on Firestone Q. D. rims. Another important point wherein this car differs from the 25 is the rear suspension, which is of the three-quarter elliptic type. The wheelbase is 120 inches. In the matter of equipment, the 35 leaves the factory with the same list as the 25, the body design in this case being almost identical with that of the little car.

Very few changes are to be noted on the 124-inch wheelbase model 40 Case. The most important one is the adoption of Bosch two-point ignition. Last year the Bosch single was used with anther make as optional. A new type of Rayfield carbureter has been brought out and the air pump for the pressure gasoline feed changed from the left to the right side of the motor.

The rear axle shafts have been made heavier and of better material. The cowl board with the instruments is something new on the 40, but in other respects the car will appear as in 1913. The motor part of the unit power plant has four cylinders cast in pairs, of 4.25 by 5.5-inch bore and stroke. The drive is taken by a disk clutch and three-speed Brown-Lipe gearset to a floating rear axle. The equipment on the 40 is identical with that of the other models.

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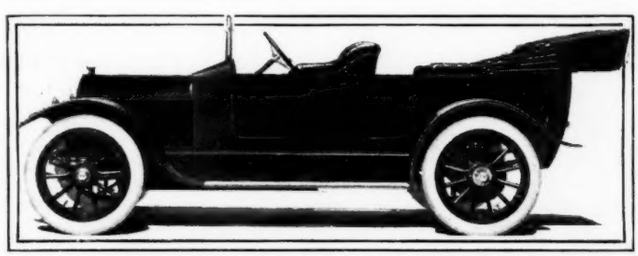
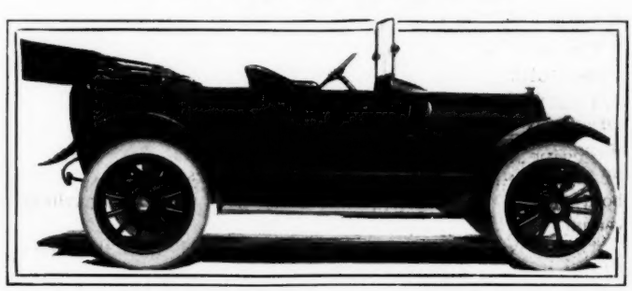
ACCORDING to the thirteenth United States census, the total horsepower used in operating the factories of the automobile industry was seven times as great in 1909 as in 1904. At both censuses, the greater part of the power was furnished by steam engines, but there was less steam power used in 1909 than in 1904, the percentages being 52 and 73, respectively.



Side view of the Case Model 35 for 1914



Right side of the new Model 25 Case

The Automobile

PUBLISHED WEEKLY

Vol. XXIX Thursday, September 4, 1913 No. 10

THE CLASS JOURNAL COMPANY
H. M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
231-241 West 39th Street, New York City

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SUBSCRIPTION RATES
United States and Mexico ---------- One Year $3.00
Other Countries in Postal Union, including Canada ---------- One Year, 5.00
To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order, or Register your letter.

Entered at New York, N. Y., as second-class matter.
The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Racing Has Its Lessons

LAST year the Elgin National race was limited to cars of 600 cubic inches piston displacement, and in the contest the winner averaged 68.9 miles per hour, and last week in this same race, with cars limited to 450 cubic inches displacement, the speed averaged 71.4 miles per hour. With smaller motors higher speeds are being obtained. Engineers are demonstrating that design is triumphing over brute strength. In other words, it is not all bore and stroke that give horsepower; rather the sustained speed of a racing car depends on many other features of design and construction.

With present racing cars it has been imperative to reduce cylinder sizes because rules demand it and yet to keep the speed up because the public demands it. To do this several courses are open. They are all followed to a greater or less degree. Valve timing is a most important factor; in fact, so important is it that racing drivers have their own timing, which is kept entirely secret, not even the motor builder or the mechanic understanding the amount of lag, advance or valve overlapping that is used. Proper valve timing means a difference of from 5 to 10 miles per hour with speedy cars.

The reduced weight of reciprocating parts, pistons and connecting-rods is giving much greater speed. In the recent Elgin races two cars of the same make and same motor sizes were pitted against each other. One had magnalium pistons, the other cast-iron pistons. The one using magnalium made circuits in 30 seconds faster than the one with cast iron. Thirty seconds to the lap means approximately 4 seconds to the mile, an aim worth striving for in racing machines.

But there is no reason for keeping the light reciprocating parts all tied up in racing machines. The touring car can profit by them as well. Light reciprocating parts mean reduced vibration, higher motor speeds, reduced gasoline consumption and smaller motors. Those concerns that are now following racing in a scientific engineering way are bound to profit over those concerns that are still continuing with heavy reciprocating parts and consuming by far too much fuel. When the fuel crisis comes in America as it has in Europe the makers will then arouse themselves to the needs of the moment and will then be compelled to follow racing practice by using lighter parts.

Some of our automobile builders are up to the minute and are already doing this. For next year one maker announces a reduction of 40 per cent. in the weight of pistons and connecting rods, accomplished by using better materials and improving the design. Others are investigating along the same line. It would be dollars in the pockets of many car builders if they would enter sanely into the racing field and proceed on an engineering line, doing everything according to rule and not following a hit-or-miss policy. There are scores of kinks in the new 1914 models, kinks that good road racing or speedway racing will bring to the surface in one-tenth the time required through the average user. It would bring these weak spots out before the opening of the season, so that whatever changes have to be made can be perfected before the product is on the market.

Taking the Elgin races as an example of troubles that may be developed by continuous high-speed work over a country road, there are lessons still to be learned, lessons that are not all wrapped up in the motor or car design, but which exhibit themselves in the motor and chassis accessories. One driver blames carbureter troubles for losing him the race, the float sticking for some reason or another. Another maker attributes some defect in frame design to his losing second or third place, the frame defect breaking no fewer than three springs in a few days. With another maker wheel troubles caused much delay. A fourth lost a good chance at first place by a poor spring suspension, not having the motor hung far enough in rear of the forward axle. The rear springs were not capable of caring for the excessive vibration due to too much weight being carried over the front axle and not enough over the rear one. Because of this poor spring suspension his tire troubles were nearly double that of others who had carefully weighed their cars over front and rear axles and had the weight adjusted with the utmost nicety.

Tire makers are learning that it appears to be desirable to make tires specially for racing purposes and cure them differently than those tires used for regulation touring work. One tire maker has been making exhaustive trials in this line, and the results he has achieved in races this year prove beyond a doubt that he has obtained commendable results. The tire makers for next year's races in Europe will have to study this question and work it out to the fifth place of decimals, because they are going to limit the number of tires to be used, and if a driver exhausts his supply he will then be out of the contest.

American racing rules call for some control of gasoline

and oil. Both are fed in exorbitant quantities. Today the automobile maker is learning little in fuel or lubricating economy, but were he compelled to go the distance on limited quantities he would change engineering details in not a few regards, and the industry would profit because of it. In the recent Indianapolis race, 500 miles, one entrant boasted of using 115 gallons of oil, almost an inconceivable quantity. In fact, the oil was being foolishly burned up and the excess passing out through the exhaust to make the track too slippery.

The mere fact that road racing has taught makers the necessity of putting good materials in all car parts is no reason why they should stay out of racing or that they have learned all the lessons of the race. There are a hundred other lessons to be learned. Car makers are erring in neglecting the opportunities offered by the speedway and road race. If they imagine they are saving money they are generally mistaken. They should not base their conclusions on the enormous cost of racing some years ago, but rather on a sane scientific method of competing in three or four good annual events. In fact, they should go about it as a matter of business.

Paris Automobile Show Will Have 685 Exhibitors

American Company Draws Best Position—U. S. Well Represented

PARIS, FRANCE, Aug. 22.—Drawing of lots for positions in the Paris automobile salon to be held from October 17 to 27 took place today, when the Hudson Motor Car Co. secured No. 1 stand, a desirable 650 square feet location directly opposite the main entrance. The Paris show, which opens the European season, will be a record one. Applications for stands have been received from 685 firms, this being the highest number for any European show. Last year the number of applicants was 630. So great is the demand for space that a number of the 60 meter stands have had to be reduced to 40 meters, the machine tool section has had to be abolished to give way to automobiles, and an attempt is being made to secure permission to build an annex for the commercial vehicle section. Last year the utility vehicles were given the smallest possible space, no firm being able to show more than one vehicle, but such is the increased demand that it is hoped to be able to place these bulky units out of doors. Plenty of space is available on the southern end of the Grand Palais for the building of a temporary hall, but permission must be obtained from the city authorities.

America will have a rather stronger representation in the Paris show than last year. The following are the firms having secured stands: Abbott (Rushmore searchlights), Benj. Briscoe, Buick, Cadillac, Case Co., Ford, Hudson, Hupmobile, Klaxon, Mitchell, Oildag, Overland, Packard, Stewart speedometers, Studebaker Corporation, Thomas B. Jeffery & Co., Vacuum Oil Co., Warner Speedometers. All these firms are exhibiting direct; other American firms are showing on the stands of French agents. The leading English firms to take part in the Paris show are Daimler, Fodens, Hele-Shaw, Humber, Hoyt Metal Co., North British Rubber Co., Palmer, Rolls-Royce, Rudge-Whitworth, Sankey wheels, Sunbeams, and Wolseley.

Locations Determined by Lot

Stand locations are awarded by the drawing of lots, French firms drawing before foreign ones in each class, unless the foreigners have exhibited in three previous Paris shows. In this case the foreigners have equal rights with the French. Although Hudson is exhibiting in Paris for the first time, the vagaries of the wheel gave it the premier position. Packard has secured a 60-meter stand at the extreme end of the double central alley. In the same row, but much nearer the central dome, is the Studebaker Corporation. Cadillac and Ford are at one end of the hall, directly facing Packard; Buick is directly behind the Packard stand. Hupmobile has also secured a stand in the central alley, at the right-hand end of the hall, sandwiched between Motobloc and Bellenger. The Thomas B. Jeffery Co. has a good stand under the main staircase.

As last year, uniform decorations will be adopted for the Paris show. Being held in mid-October, when evenings are still light, the expenditure for electricity will be reduced and the luminous roof will be abolished. The general effect will be no less attractive than in preceding years, and the total amount spent on decorations will be the same as last year. It is declared that an entirely original and effective decorative scheme will be adopted.

The duration of the show having been reduced from 3 weeks to 11 successive days, it has been decided to abolish all free passes and to make the opening day one of real business, instead of a popular gala display. Instead of closing at 6 o'clock, the show will remain open until 7 o'clock each evening.

As on previous years, the show is in the hands of a joint committee of which Louis Renault is now the President. Armand Peugeot, who has held this position for several years, retired during the present season. The general management of the show is still in the hands of Henri Cezanne, who was responsible for the last two successful shows. The early show has been adopted in order to eliminate some of the slack period which existed in the factories between the close of the touring season and the opening of the winter exhibitions. During October Paris is not as full of natives as during the month of December, but it generally houses a very large number of wealthy foreigners. Many of the visitors from the United States have not returned home at this period, wealthy South Americans are usually to be found in the city in big numbers, and buyers for big foreign firms all over the world make a point of visiting Paris during the month of October with a view to winter purchases. It is considered, therefore, that there will be an increased foreign element at the show and a greater volume of business done with foreign countries.

Following the automobile show there will be an aviation exhibition in the Grand Palais during the month of December.

May Not Confirm Cutting Sale

DETROIT, MICH., Sept. 3—*Special Telegram*—While the property of the Cutting Motor Cara Co., Jackson, Mich., was sold at public auction to W. M. Thompson, of the Jackson City Bank for the sum of $30,000 it is doubtful if the sale will be confirmed by Judge Sessions when the matter comes up for action on September 9, many of the creditors believing the amount too low. It is stated by the receivers, the Security Trust Co., Detroit, that several other higher bids are expected at that time.

DETROIT, MICH., Sept. 3—*Special Telegram*—Although the inventory and appraisal of the Michigan Motor Car Co., Kalamazoo, Mich., was completed on September 1, Judge Sessions has requested that no figures be given out prior to the hearing of the case, which is scheduled for September 24. It has been variously reported that the Edward F. Gerber Co., Michigan distributor in Pittsburgh, Pa., had bought the plant and would continue the making of motor cars, but the Detroit Trust Co., receiver for the Michigan company states that no such sale has been consummated, although the Gerber concern made certain overtures leading to such an end which were not acceptable to those interested.

S. A. E. Wheels Standards Committee to Meet

NEW YORK CITY, Sept. 3—A meeting of the Pleasure Car Wheels Division of the Standards Committee of the Society of Automobile Engineers will be held on September 9, at eight o'clock, at 1790 Broadway, for the purpose of taking up further the matter of standardization of rims for pneumatic tires.

The following are members of the committee: Mr. Henry Souther, chairman; G. G. Behn, H. L. Barton, C. C. Carlton, R. S. Bryant, E. R. Hall, C. E. Reddig, J. G. Vincent, C. B. Whittelsey, C. B. Williams, Howard Marmon, ex-officio; Coker F. Clarkson, secretary

TORONTO, ONT., Sept. 2—The B. F. Goodrich Tire & Rubber Co., of Akron, Ohio, has decided to build a large Canadian branch in Toronto, according to word from head office of that concern just received here. The branch, the Goodrich Company states, will employ 1,800 workmen at the start. The location of the factory has not yet been made public.

Derny, winner of the Belgian Grand Prix, on his Springuel

Derny Wins 2-Day Belgian Grand Prix

Sava Cars Driven by Berger and Sauveniere Secure King's Cup for the Best Team Performance

Derny Covers Course of 495 Miles Without Dropping Below 44 Miles Per Hour—Average Speed 56 Miles

SPA, BELGIUM, August 26.—Derny on Springuel won the Belgian Grand Prix today, and the Sava Company, with Berger and Sauveniere driving, secured the King's Cup for the best team performance. The race was a combination of speed and regularity. On the first day a distance of 235 miles had to be covered, and on the second day the distance was 260 miles. For every two laps of the course—26 miles—the cars had to show a minimum speed according to their cylinder area. Thus the winner, with a motor of only 2.9 by 4.7 ins. bore and stroke had to show not less than 44 miles an hour on each section, or be penalized one point for every 30 seconds delay. Each regularity section was considered independently. Speed on one section would not wipe out delay on a following section. Over the total distance of 495 miles the winner averaged a small fraction under 56 miles an hour. The two other Springuel cars were eliminated by collisions during the race. Sava, the winner of the King's Cup, was the only firm having more than one car in the race at the finish. The third car of this team was eliminated by a collision.

Fourteen Starters in Race

There were 14 starters in the race. They comprised Sava 2.9 by 4.7 ins.; F. A. B., 3.2 by 5.5 ins.; Springuel, 2.9 by 4.7 ins., each with three cars, and the following individual entries: Wilford on Benz (3.1 by 5.1 ins.), Jerusalem on Linon (2.9 by 5.9 ins.), Fusellier on Gallia (2.9 by 5.1 ins.), Loeffler on Hansa (3.7 by 5.9 ins.), and Elskamp on Mercedes (3.9 by 5.1 ins.)

There were serious accidents on the first day. Gallico, the driver of one of the Springuels had a bad skid on one of the sharp turns, the car being turned over and the two men thrown clean. At the same instant one of the F. A. B.'s came round the bend and dashed into the overturned Springuel. This latter car was completely wrecked. The F. A. B. was too badly damaged to continue in the race. The men escaped with very slight injuries. A few minutes later, Baron de Woelmont on Sava was endeavoring to overtake Klinkhamer's Springuel when the front right wheel of the Sava caught in the left rear wheel of the leading car. The Springuel was thrown into the ditch; the Sava mounted a bank 6 feet high, carried away 2 trees, and threw De Woelmont into a field, where he was killed. The mechanic was rather seriously injured. The two men on the Springuel got off with a few bruises, but their car was wrecked. Mechanical defects put out a few other cars, with the result that at the end of the day there were only 5 machines qualified for the second stage. These were Elskamp on Mercedes, who had covered the first two laps at an average of 57 miles an hour, Derny on Springuel, Berger on Sava, Sake on F. A. B., and De Cauveniere on Sava.

An attempt was made to stop the race at the end of the first day, but the authorities declined to intervene. There were no incidents of any importance. Elskamp on Mercedes, who was looked upon as a certain winner, lost time at the end and went down two places, allowing the Springuel driven by Derny to get in first. Berger came in second, on Sava; Elskamp third on Mercedes; Sake fourth on F. A. B., and De Sauveniere fifth on Sava.

Preceding the Grand Prix race there was a "rally" open to racing and touring cars, and a hill climb on formula. There were over one hundred competitors, among them being a Hupmobile and an A. M. A., a new arrival from Michigan. Neither of the American cars succeeded in getting among the first half dozen. In the rally there were three sections, the respective winners being Erl on Benz, Noel on Bugatti, and Joerns on Opel. In the hill climb the winners were: racing cars, Derny on Springuel 200 points; Gallico on Springuel, 190 points; Wery on Nagent, 165 points; Sporting type cars, Klinkhamers on Springuel, 170.5 points; Noll on Bugatti, 145.2 points; Dasse on Dasse, 113 points. Touring section, Erle on Benz, 131.5 points; Cauveur on Sunbeam, 106.5 points, and Edeman on F. A. B., 75 points.

Twenty-four Entries for L'Auto Cup

PARIS, FRANCE, Aug. 22—Twenty-four cars are entered for the Coupe de l'Auto 3-liter race to be run at Boulogne-sur-Mer on Sunday, September 21. This is the final long distance French race of the year, and probably the last occasion on which the race will be run. It is believed that after 4 years' experience of the 3-liter rule manufacturers have secured all the benefit to be obtained from these racing conditions, and a change will doubtless be made for next year. The firms entered are Peugeot (3), Delage (2), Koecklin (4), Schneider (3), Zenia (2), Sunbeam (3), Alda (2), Anasagasti (1), Vauxhall (2) and Buick (2). The Alda cars are a comparatively new make, now being built by Ferdinand Charron, one of the founders of the old C. G. V. Co. The Koecklins are 2-cycle sleeve valve motors; the Anasagasti is a car built in France specially for the South American trade. One of the Buicks will be driven by Repusseau, the French agent; the driver of the second Buick has not yet been appointed.

Brighton Beach Race Track Sold

BROOKLYN, N. Y., Aug. 28—The property owned by the Brighton Beach Racing Association, at Brighton Beach, was sold to-day to foreclose two mortgages, aggregating $900,000. The foreclosure proceeding was brought by Michael McBreen against the Brighton Beach Racing Association. He made two loans on the company's property, one for $110,000, and another for $50,000. McBreen and the Bay Realty Co. were also named as defendants in the injunction suit. The sale was made in four parcels, three to J. P. Hudson for $1,058,000, and the fourth to H. E. Lewis.

Elskamp's Mercedes at the tire pits in the Grand Prix

Gallico's wrecked Springuel in the Belgian Grand Prix

New Management for Mitchell-Lewis Co.

McClaren Made President and General Manager—N. Y. Bankers Promise Unlimited Financial Aid

Reorganization To Place Company in Front Rank Among American Automobile Manufacturers

CHICAGO, ILL.—*Special Telegram*—As the result of the meeting of the board of directors of the Mitchell-Lewis Motor Company, of Racine, Wis., a $10,000,000 corporation, today, two tremendously important matters to followers of the automobile industry were emphasized. Not only did the board make an almost complete change in the management of the big company, but it received the assurances of White, Weld & Co., 14 Wall street, New York City, the concern that recently refunded the indebtedness of the motor company, that it was prepared to furnish the veteran corporation with unlimited financial backing which would result in placing it back in the front rank of the list of American automobile manufacturers. Representatives of the motor and banking interests who were present at the meeting of the board of directors accepted as a sign of the optimism of eastern capitalists the enthusiasm of White, Weld & Co. in following the re-issuing of Mitchell-Lewis Motor Co. bonds with unqualified statements of faith in the organization.

The Mitchell-Lewis Motor Co., Racine, Wis., announces a new management composed as follows:

Beach L. McClaren, president and general manager; John W. Bate, first vice-president and general factory manager; William T. Lewis, second vice-president; F. L. Mitchell, treasurer; H. E Redman, secretary; O. C. Friend, general manager; G. W. Morgan, purchasing agent; M. J. Gillen, general counsel.

Mr. McClaren was formerly with the United States Tire Co. and a little more than a year ago became vice-president and general sales manager of the Racine Rubber Co. Mr. Bate was general factory manager of the Mitchell-Lewis Motor Co. from its inception until February 1, 1912.

Joseph Winterbotham, Jr., retires from the presidency of the Mitchell-Lewis Motor Co. because he feels that his health demands a considerable period of rest. Mr. Bate succeeds G. Verner Rodgers. Mr. Friend is promoted from advertising manager and succeeds Leo A. Piel.

A.A.A. Disqualifies Many Drivers

NEW YORK, Aug. 26.—At a meeting of the Contest Board held at A. A. A. National Headquarters today, the following action was taken:

The application for reinstatement to good standing of E. V. Rickenbacher, of Des Moines, Ia., formerly a registered driver, who was under disqualification until Jan. 1, 1914, for participating in unsanctioned track events in the Middle West during the summer of 1912, was favorably considered, in view of additional facts personally presented by him tending to mitigate his violation of the Contest Rules and he was reinstated to good standing as of June 28.

The following disqualifications and suspensions were imposed for violation of Rule 75 of the Contest Rules on Advertising:

Gwinn Sales Co., Lozier agent at Columbus, Ohio, to Jan. 1, 1914, for advertising in the program of the 200-mile track race held at Columbus on July 4, that the Lozier cars competing in the Vanderbilt Cup, Fairmount Park and Santa Monica road races and other events were "stock" cars—"the same car that is delivered to every Lozier buyer.

G. L. Sitgreaves, Mercer agent at Columbus, to Jan. 1, 1914, for advertising in the same program that the No. 4 Mercer car entered by him and participating in the race was "The only stock car in the race."

Mercer Auto & Supply Co., Mercer agent at Cleveland, to Jan. 1, 1914, for advertising in their sales room show window at Cleveland that the No. 22 Mercer, which finished in second place at the 500-mile Indianapolis race on May 30 was a "stock" car.

Nyberg Automobile Works, Anderson, Indiana, to Jan. 1, 1914, for advertising in the public press the No. 1 Nyberg car which participated in the Indianapolis race was a "stock" car.

K. C. Pardee, Briggs-Detroiter agent at New York City, to Sept. 1, 1914, for advertising in the sales room show window that the Briggs-Detroiter which took part in the combined economy, hill climb and reliability tour, held May 14 and 15, as "wins first prize in Catskill economy and reliability tour," which claim is not in accord with the official report filed with the Contest Board by the board's representative and the referee.

Harold A. Hall, registered driver, of Fresno, Cal., was disqualified and suspended until Jan. 1, 1914, for participating in an unsanctioned track meet at Salinas, Cal., on April 6, 1913, notwithstanding warning given him by the board's representative.

R. H. Pennebaker, of Memphis, Tenn., was disqualified and suspended until Sept. 1, 1914, for violation of Rule 62 in not reporting for start the car entered by him for the 500-mile race at Indianapolis, or having been regularly excused by the Referee.

Chas. B. Perry, of Santa Ana, Cal., was disqualified and suspended until Sept. 1, 1914, for a like violation in not reporting for start the No. 46 Metz entered by him in the Los Angeles to Sacramento road race, held July 4.

Because of their participation in the unsanctioned hill climb held at Mount Vernon, New York, on May 30, 1913, the following unregistered drivers were declared ineligible to take part in sanctioned events until after Jan. 1, 1914:

C. R. Kenyon, Yonkers, N. Y., Simplex.
A. N. Kerr, Yonkers, N. Y., Fiat.
W. H. Bowman, White Plains, N. Y., Oldsmobile.
B. B. Kendig, Mt. Vernon, N. Y., Metz.
N. Brown, Mt. Vernon, N. Y., Oldsmobile.
John S. Clark, Porchester, N. Y., Buick.
A. S. Jenks, Ford.

H. Van Wyck, of Hartsdale, N. Y., formerly a registered driver, was disqualified and suspended until September 1, 1914, for driving his Mercer car in this event, and P. G. Thebaud, Jr., of White Plains, a 1913 registered driver, was disqualified and suspended for two years on September 1, 1915, for driving a G. J. G. car under the alias or assumed name of "N. E. Smith."

For participation and connection with the unsanctioned auto speed events held upon the unlicensed three-lap motorcycle track at Point Breeze, near Philadelphia, on August 12, the following were disqualified, suspended and rendered ineligible to take part in sanctioned events until January 1, 1914:

F. C. Bishop, driver of Abbott-Detroit.
V. P. Padula, entrant and owner of above car.
Geo. H. (Dare Devil) Jones, owner and driver of Traveller Special.
Eddie Bauer, driver of Buick.
J. C. Dunsmoor, owner of Buick, also scorer.
C. B. Higgins, judge.
J. Signor, scorer.
Frank Shaw, timer.
W. B. McCullough, timer.

The claim of Barney Oldsfield for official record for one mile in 46⅗ seconds, Bakersfield, Cal., April 27, 1913, was not accepted and allowed for the reason that the board did not feel the Pendleton automatic timing device with which the time trial was timed met the requirements of Rule 78.

Baron de Woelmont, who was killed on Sava in fatal collision

Government To Buy More Automobiles

WASHINGTON, D. C., Sept. 2—*Special Telegram*—The Government is in the market for a number of motor vehicles, bids for which will either shortly be called for or purchases made in the open market. Col. Rheulin is contemplating purchase of three automobiles for the National Soldiers' Home here.

The Sergeant-at-Arms of the United States Senate contemplates the purchase of three or more trucks for delivery of mail to senators. The Government printing office is inviting bids for an electric carriage, while the War Department, through the chief of the supply division, is in the market for a truck, and the Postoffice Department is preparing a schedule for bids for miscellaneous automobile supplies, including tires. Manufacturers interested should communicate with the officers mentioned.

R. C. H. Liabilities $1,998,114—Assets $866,553

DETROIT, MICH., Sept. 3—*Special Telegram*—Inventory of the assets and liabilities of the R. C. H. Corp., which went into the hands of a receiver recently, has just been completed. The Security Trust Co., receiver, today mailed a statement to all of the concern's creditors showing total assets of $866,552.89 and liabilities of $1,998,114.16. The receiver has called a meeting of those interested for September 9.

DETROIT, MICH., Sept. 3—*Special Telegram*—Sixty dealers from all parts of the country who handle Hupmobiles are in convention at the Hupp Motor Car Co.'s factory. This annual get-together meeting will extend over tomorrow, two business sessions taking place each day. Various phases of the selling of the Hupp product will be touched upon while the 1914 line, consisting of a four- and a six-cylinder model, will be revealed to the field men. A banquet tomorrow night at the Pontchartrain terminates the convention.

To Reorganize Grand Rapids Co.

GRAND RAPIDS, MICH., Sept. 1—With the sale of the assets of the Grand Rapids Motor Truck Co. to Frank T. Hulswit, the highest bidder, it is announced that there will be a reorganization of the company and that the motor truck manufacturing industry will be placed on a paying basis. Mr. Hulswit's bid was $17,050 when the property was offered for sale by the Grand Rapids Trust Co., appointed receiver by Judge Sessions in the United States court here. The receiver's equity was $6,500, and Mr. Hulswit assumed the real estate mortgage. The receiver will handle accounts and bills receivable to the amount of about $7,000.

DETROIT, MICH., Sept. 2.—Reorganization of the Seitz Automobile Transmission Co., which bought the majority of the machinery, dies, jigs, patterns and other fixtures of the Grabowsky Power Wagon Co. at receivers' sale early in the year, has been effected and the name of the concern changed to the Detroit-Wyandotte Motor Co. and the capital stock made $500,000. Motor trucks are being manufactured at the rate of about 100 a month in a large range of sizes. These resemble the former Grabowsky types to a great extent, and while retaining most of the essentials of these the removable power plant feature over which there has recently been some patent litigation has been discontinued.

New Six-Passenger American Out

INDIANAPOLIS, IND., Sept. 1.—The latest 1914 model to be announced by the American Motors Co. is a six-passenger car known as type 646. The figures denote six cylinders, 40 horsepower and six-passenger capacity. The new body embodies the latest features in body design, being a streamline with high flush sides and deep seats. It is a marked departure from the past policy of the company to limit the passenger capacity of its lower-priced cars to four persons, and in reality takes the place of the American Traveler. It lists at $2,950 with complete equipment.

In many respects this new car is identical with the type 644, the principal changes being the lengthening of the wheelbase to 140 inches, a change in motor size to 4.25-inch bore and 5.5-inch stroke and a new electrical equipment. This new equipment is of the two unit type, with both units mounted in one housing.

The motor is a block casting, but with separate exhaust ports for each cylinder; the exhaust manifold being bolted on and easily removed. The cylinders are most accessible in the event of its being necessary to scrape carbon. The lubrication is splash and force feed to main bearings and connection rod bearings, the splash level being maintained and oil forced to main bearings by a positive gear pump. In other respects the motor is identical with that used in the type 644. The transmission, rear system, tires and equipment are exactly the same as those in the four-passenger model, with necessary changes in the springs, etc., to take care of the additional body and passenger weight. The two standard colors in which this car is offered are Battleship gray or Thistle green. The upholstery is Turkish, deep black, with a dark gray top, and black enamel and nickel trimmings.

The S. & M.—a New Detroit Car

DETROIT, MICH., Aug. 29—Detroit's newest manufacturer of automobiles is the S. & M. Motor Co., Inc., in which are interested Edward E. Stroebel, the furniture manufacturer of New York, and Walter C. Martin, formerly of New York and now of Detroit. Mr. Martin entered the motor car business in 1902 as New York dealer in Cadillac cars and came to Detroit in May to arrange for the manufacture of a car for the New York market. Within the last few days the S. & M. company secured a large factory containing 50,000 square feet of floorspace at 1900 Mt. Elliott avenue, Detroit. This building is two stories in height and is large enough to enable the company to construct 1,000 cars. The S. & M., as the car will be known, is made in four models. The runabout will list at $2,485, a five-passenger touring car at $2,485, seven-passenger touring car at $2,535 and a limousine at $3,500. Continental special engines, six-cylinder, 3 3-4-inch bore by 5 1-4-inch stroke and yielding 58 horsepower at 2,000 revolutions, will be used. In assembling this car Mr. Martin selected Bosch dual magneto, Timken front and rear axle, wire wheels with Timken hubs, Warner four speed transmission, Gemmer steering gear, Rayfield carbureter, Mayo radiator, Parish & Bingham frames, Spicer universal joints, Firestone tires, Electroc self-starter. Te car will have left-hand drive central control and will be fully equipped with every device known. The wheel base will be 130 inches, the weight of the car 3,250 pounds.

Davis Is the Latest Cyclecar

DETROIT, MICH., Sept. 2.—Among the latest to appear in the Detroit cyclecar list is the Davis Cyclecar Co., with William N. Davis as the designer. The car will be a tandem type, the steering being done from the rear seat. The power plant will be a Spacke motor of air-cooled type, while its power will pass through a three-speed gearset and thence by silent chain to the rear axle. The Davis machine weighs under 600 pounds, has a wheelbase of 93 inches and a tread of 36 inches. It will have wire wheels and in other respects will conform to cyclecar ideas. The Davis company is being heavily financed, it is understood, and plans to manufacture several thousand cars during the 1914 season.

To Make Wire Wheels in Detroit

DETROIT, MICH., Sept. 2.—The manufacture of wire wheels is to be undertaken in Detroit by a newly organized concern known as the Cameron Wire Wheel Co. The capital stock is $37,500, of which $25,000 has been paid in. Those interested in the concern are F. F. Cameron, who several years ago was interested in the making of the Cameron air-cooled motor car in the East; A. A. Leslie and W. E. Carpenter. The Cameron wire wheel is of simple construction and is designed to be applied to existing hubs without alteration, the inner section of the wheel bolting to the ordinary wood wheel flange after the wood spokes have been removed. The demountable feature is obtained by removing these holding bolts.

Change in Palmer-Singer Officers

LONG ISLAND CITY, N. Y., Aug. 29—At a special meeting of the board of directors of the Palmer & Singer Mfg. Co., held August 27, a change in the management took effect. Charles A. Singer, Sr., resigned the presidency of the company for the office of first vice-president, in favor of Clyde D. Knapp, former first vice-president, who was elected to succeed Mr. Singer as president of the company, to represent certain Standard Oil interests in control of the Motor & Gear Improvement Co.

To Announce Lincoln Route September 14

DETROIT, MICH., Sept. 2—*Special Telegram*—On Sunday, September 14, will be announced throughout the country the route of the Lincoln Highway. All are urged whether on the route or not to decorate their places of business with Lincoln way banners, Lincoln portraits, American flags and bunting and with large poster copies of the proclamation. We will furnish poster copies of proclamation, on request, from here.—HENRY B. JOY, president Lincoln Highway Association.

Krit Affairs Turning Out Well

DETROIT, MICH., Sept. 3—*Special Telegram*—The Krit Motor Car Co., which was recently forced to seek the aid of its creditors, due to the general financial stringency of the country, and the adverse weather conditions in the Southwest, where Krit cars have their greatest sale, yesterday held another meeting with about 100 of its creditors, all of whom are willing to help the concern out of its temporary difficulties and assist in the continuation of the business. An agreement has been entered into with all of the larger creditors whereby all of their indebtednesses will be eventually squared away. Four changes have been made in the board of directors which consists of seven members, the new directors being three of the principal creditors, together with a representative of the Union Trust Co. There seems to be no doubt in the minds of any concerned that the business will be continued without capital increase, the banks having assured the concern of all necessary working capital within reason. The company has parts for over 1,000 cars and at the present time is shipping from seven to nine cars a day. The largest creditor is Walter S. Russell, indebtedness to him amounting to approximately $300,000, and the agreement which has been entered into between the company and its creditors stipulates that Mr. Russell will not participate in payments of indebtedness until 50 per cent. of the indebtedness of the other creditors has been paid.

Co-Receiver for Walpole Appointed

BOSTON, MASS., Aug. 31.—The final decision relative to whether or not a co-receiver should be appointed to act with Receiver Fischer, appointed to take charge of the affairs of the Walpole Tire & Rubber Co., was settled Wednesday when Judge Dodge in the United States District Court named ex-Congressman Robert O. Harris to act with Mr. Fischer. Mr. Harris was formerly a judge in the Superior Court on the Massachusetts bench, who resigned to run for Congress. Of late he has been acting as master, referee and receiver in litigation.

New Truck Factory for Indianapolis

INDIANAPOLIS, IND., Sept. 1—Another motor truck factory is to be established in Indianapolis soon, the Koogle Auto Co., now in the repair and painting business, having arranged to build and distribute the 1.5-ton Auglaize truck, now manufactured at New Bremen, O. As a preliminary step, the Koogle company is letting contracts for a two-story factory building 80 by 175 feet. The company also expects to take the agency for several trucks that will not conflict as to size with the Auglaize, thus giving it a complete line of trucks in various sizes.

EAST MOLINE, ILL., Sept. 2—The plant, machinery and other tangible assets of the Midland Motor Co. will be sold on September 23, at 10 a. m.

Automobile Securities Quotations

There was an absence of any changes of importance in this week's stock prices. The prices, with but a few, remained at last week's quotations, there being little bidding. Those stocks which did change, showed little change. The General Motors Co., common, lost 6 1-2 points; the Goodyear Tire & Rubber Co., common, rose 5 points.; The Pope Mfg. Co., preferred, showed a 1 point gain; The Studebaker Co., common, dropped 1 1-2 points; The U. S. Rubber Co., common, dropped 1 1-2 points and the Willys-Overland Co., common, rose 1 point.

	1912		1913	
	Bid	Asked	Bid	Asked
Ajax-Grieb Rubber Co., com	145	165	150	170
Ajax-Grieb Rubber Co., pfd	95	100	95	100
Aluminum Castings, pfd	99	102	98	100
American Locomotive Co., com	45¾	46	35½	36
American Locomotive Co., pfd	109	110	101½	103
Chalmers Motor Company, com	..	..	100	108
Chalmers Motor Company, pfd	..	..	97	102
Consolidated Rubber Tire Co., com	14	17	28	30
Consolidated Rubber Tire Co., pfd	50	60	88	100
Firestone Tire & Rubber Co., com	285	290	..	280
Firestone Tire & Rubber Co., pfd	106	108	102	105
Fisk Rubber Company, com	..	..	..	..
Fisk Rubber Company, pfd	..	..	..	..
Garford Company, preferred	99	101	92	95
General Motors Company, com	42	43	36½	38
General Motors Company, pfd	82	83	79	81
B. F. Goodrich Company, com	77½	79	28	30
B. F. Goodrich Company, pfd	107½	108½	90	91
Goodyear Tire & Rubber Co., com	330	334	270	280
Goodyear Tire & Rubber Co., pfd	105	106½	97	98
Hayes Manufacturing Company	..	97	..	..
International Motor Co., com	27½	28½	..	5
International Motor Co., pfd	84	85	10	18
Lozier Motor Company, com	..	..	16	..
Lozier Motor Company, pfd	..	..	..	90
Maxwell Motor Co., com	..	..	4	4½
Maxwell Motor Co., 1st pfd	..	..	8½	10
Maxwell Motor Co., 2nd pfd	..	..	30	34
Miller Rubber Company	142	150	135	138
Packard Motor Company, pfd	105½	107	..	99
Peerless Motor Company, com	..	..	32	38
Peerless Motor Company, pfd	..	..	86	90
Pope Manufacturing Company, com	38½	40	8	11
Pope Manufacturing Company, pfd	73½	74½	29	33
Portage Rubber Co., com	..	..	..	40
Portage Rubber Co., pfd	..	..	..	90
Reo Motor Truck Company	9¾	10¾	..	11
Reo Motor Car Company	22½	24½	..	18
Rubber Goods Mfg. Co., pfd	..	..	102	106
Studebaker Company, com	42½	43½	23	25
Studebaker Company, pfd	94	95½	80	86
Swinehart Tire Company	95	97	85	88
U. S. Rubber Co., com	..	..	61	62
U. S. Rubber Co., 1st pfd	..	..	105	106
White Company, preferred	107	109	104	107
Willys-Overland Co., com	..	..	62½	64
Willys-Overland Co., pfd	..	..	86	92

Market Changes of the Week

Few changes of any consequence occurred in this week's markets. Tin experienced a fluctuating week. Starting on Wednesday at $42.50 it rose $43.60, when a reaction set in, dropping to $42.88 on Monday. On Tuesday, the tone of the market was stronger with prices slightly higher. Little business was done. Tin closed at $43.13, a rise of $.63. Both electrolytic and Lake coppers rose $.00 1-8 per pound. The production of refined copper in August is estimated to have been between 135,000,000 and 140,000,000 pounds. The situation in the Lakes has affected deliveries as well as production to a moderate extent. Open-hearth steel lost $1.00 per ton, when it dropped to $24.00 on Thursday. The situation in the market for automobile scrap rubber underwent no change in this week's markets. Cottonseed oil underwent a sharp advance in price on Tuesday, closing at $8.50 per barrel. This is $0.50 in advance of the opening prices. The sharp advance in cotton had only a moderate effect on cottonseed oil, prices for which moved upward at the close. Offerings were not liberal, however, and there was comparatively little short selling, profit-taking sales being those most in evidence. Antimony remained constant at $0.07 1-2 per pound. The silk markets were dull this week, very little trading taking place. Gasoline and rapeseed oil were unchanged.

Material	Wed.	Thurs.	Fri.	Sat.	Mon.	Tues.	Week's Change
Antimony, lb.	.07½	.07½	.07½	.07½	.07½	.07½	.....
Beams & Channels, 100 lbs.	1.61	1.61	1.61	1.61	1.61	1.61	.....
Bessemer Steel, ton	25.00	25.00	25.00	25.00	25.00	25.00	.....
Copper, Elec., lb.	.15⅞	.15⅞	.15⅞	.15⅞	.15⅞	.16	+ .00⅛
Copper, Lake, lb.	.16	.16	.16	.16	.16	.16⅛	+ .00⅛
Cotonseed Oil, lb.	8.00	8.16	8.20	8.22	8.25	8.50	+ .50
Cyanide Potash, lb.	.19	.19	.19	.19	.19	.19	.....
Fish Oil, Menhaden, Brown.	.33	.33	.33	.33	.33	.33	.....
Gasoline, Auto, 200 gals.	.22¼	.22¼	.22¼	.22¼	.22¼	.22¼	.....
Lard Oil, prime	.95	.95	.95	.95	.95	.95	.....
Lead, 100 lbs.	4.85	4.80	4.80	4.80	4.75	4.75	— .10
Linseed Oil	.53	.53	.53	.53	.53	.53	.....
Open-Hearth Steel, ton	25.00	24.00	24.00	24.00	24.00	24.00	—1.00
Petroleum, bbl., Kansas crude	1.03	1.03	1.03	1.03	1.03	1.03	.....
Petroleum, bbl., Pa., crude	2.50	2.50	2.50	2.50	2.50	2.50	.....
Rapeseed Oil, refined	.68	.68	.68	.68	.68	.68	.....
Silk, raw Italy	....	5.20	....	....	....	....	.....
Silk, raw Japan	....	4.43	....	....	....	....	.....
Sulphuric Acid, 60 Baume	.90	.90	.90	.90	.90	.90	.....
Tin, 100 lb.	42.50	43.60	43.50	43.00	42.88	43.13	+ .63
Tire, Scrap	.09½	.09½	.09½	.09½	.09½	.09½	.....

MUSKEGON, Specialties' Plant—The Muskegon Motor Specialties Co., Muskegon, Mich., is at work on an addition to its present plant, and it is expected the addition will be completed within the next month. The addition comprises a brick, concrete and steel building, 65 by 75 feet, and will give the company about 5,000 additional feet of floor space. It will be used for stockroom purposes, the present stockroom facilities of the company being inadequate.

Imperial Wheel Enlarging—The Imperial Wheel Co., of Flint, Mich., is at work on two large sheds, one being an addition to the boiler room, 30 by 48 feet, and the other being 50 by 70 feet. Both sheds are of concrete.

Sternberg's $40,000 Addition—The Sternberg Mfg. Co., manufacturing motor trucks, has broken ground for a $40,000 addition to be 150 by 150 feet in size.

Golden West Co. Purchases—The Golden West Motor Co. has purchased a site covering about 6 acres in Park Villa, Sacramento, Cal., and will erect an automobile factory.

Fire in Goodyear Plant—Fire recently destroyed the rubber coat department of the Goodyear Rubber Co., Akron, O., entailing a loss estimated at between $75,000 and $100,000.

Gramm Records Destroyed—Records in the office of the Gramm-Overland Co., of Lima, O., were destroyed, the shipping platform burned and twenty trucks endangered in a blaze at the factory recently. The origin of the fire has not been learned.

Wants Plant in Kenosha—The Commercial Club, of Kenosha, Wis., is negotiating with a large Chicago concern manufacturing pneumatic and semi-pneumatic tires for pleasure and commercial cars to move its plant to Kenosha. It is said there is a strong likelihood that the removal will be accomplished.

Work on Beaver Plant—Work has been commenced on the factory of the Beaver State Motor Co., Gresham, Ore., a suburb of Portland, Ore., upon a 5-acre tract located on the Mt. Hood line. The Beaver State Motor Co. is organized under the laws of the State of Oregon, having a capitalization of $300,000. The company will manufacture automobiles.

Motor Truck Buys Plant—It was reported recently that the plant of the defunct Model Typewriter Co., Harrisburg, Pa., has been purchased by the Morton Truck and Tractor Co., and would be put into immediate use by that company for manufacturing of motor trucks. This factory is a large three-story brick structure, with every facility and requirement for a large manufacturing concern.

Continues to Make Parts—The International Cordless and Weightless Window Co., Ambridge, Pa., pending the arrival of some new machinery recently ordered, has a force of men busy on orders for metal parts of automobiles, which character of goods was made by the Keystone Co., and for which some of its machinery was specially designed. It is probable that the new company will continue this character of work.

S. & M. Co.'s Plant—The S. & M. Rubber Co., which was capitalized recently with $100,000 capital, has secured subscriptions for $48,000 of the stock. Of the $48,000 subscribed, one-third is preferred and two-thirds is common. Officials of the company are proceeding with the repairs and additions to the factory at Cambridge Road and the Wheeling & Lake Erie crossing. The announcement is made that the plant will be in operation in two months.

General Motors Will Use Plant—Following the recent demand of the mayor of Owosso, Mich., upon the General Motors Co. for the return of $25,000 given as bonus money for the establishment of the Reliance Motor Truck plant here, officials for the General Motors Co. have stated that the plant recently vacated by the Reliance company, which removed to Pontiac, will be used by some other branch of the business of the General Motors Co.

Parts Factory in Dodgeville—N. C. Miller and son William, of Dodgeville, Wis., have purchased buildings and factory site and will engage in the manufacture of farm implements and machinery, at the same time preparing to market several important inventions of motor car parts. The Millers have valuable patents on a four-wheel drive, a universal joint and a differential set which are now being perfected. A garage and agency business will be conducted as part of the manufacturing business.

Fire Destroys Showalter Factory—Fire recently destroyed the factory of the Showalter Mfg. Co., Indianapolis, Ind. The company manufactures automobile bodies and has a large business. The fire loss to the company was about $12,000, while automobiles valued at $18,000, and belonging to various persons and companies, were also destroyed. This company also suffered considerable loss in the March flood. It expects to immediately obtain a new factory in another part of the city and announces there will be little interruption to business.

Crown Car Co.'s Plant—The Crown Motor Cars and Foundries, Ltd., of Montreal, Que., is a new corporation with a capital stock of $100,000, of which $50,000 has already been paid in. The directorate is chiefly composed of the stockholders of the Sorel Iron Works, Ltd., who formerly owned and operated the St. Lawrence Saw and Steel Works Company, Ltd., a business of 30 years' standing. It is the intention of the Sorel Iron Works, Ltd., to move its factory from its present location at Sorel to Maissoneuve, in Greater Montreal, and to combine within its new buildings now under construction a plant for the manufacture of automobiles.

The Automobile Calendar

Shows, Conventions, Etc.

Sept. 10.....New York City, S. A. E., Monthly Meeting Metropolitan Section.
Sept. 17-18.....Cleveland, O., Annual Meeting of the National Brick Manufacturers Assn.
October 13.....Philadelphia, Pa., National Fire Prevention Conference, Philadelphia Fire Prevention Commission.
Oct. 27-28.....Chicago, Ill., Convention of Electric Vehicle Association of America.
Oct. 27-28.....Chicago, Ill., Fourth Annual Convention, Electric Vehicle Assn. of America.
Dec. 9-12.....Philadelphia, Pa., Annual Convention of American Road Builders' Association.
Dec. 11-20.....New York City, First International Exposition of Safety and Sanitation, under the auspices of the American Museum of Safety.
Jan. 3-10, 1914.....New York City, Automobile Show, Grand Central Palace.
Jan. 24-31, 1914....Chicago, Ill., Automobile Show, Coliseum and First Regiment Armory.
Jan. 26-31, 1914....Scranton, Pa., Automobile Show, Automobile Assn. of Scranton.
Jan. 31-Feb. 7, 1914.Minneapolis, Minn., Automobile Show.
Feb. 2-7.....Buffalo, N. Y., Automobile Show, Buffalo Automobile Dealers' Assn.
Feb. 9-14.....Buffalo, N. Y., Truck Show, Buffalo Automobile Dealers' Assn.
Feb. 21-28.....Newark, N. J., Automobile Show, N. J., Auto Trade Assn.
Feb. 22-March 5....Cincinnati, O., Automobile Show, Cincinnati Automobile Dealers' Assn.

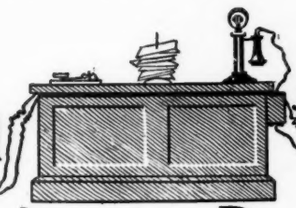
Race Meets, Runs, Hill Climbs, Etc.

Sept. 6.....Track, Hamline, Minn., Minnesota State Fair.
Sept. 8-13.....Chicago, Ill., Around Lake Michigan Run, Chicago Motor Co.
Sept. 9.....Corona, Cal., Track Race, Corona Automobile Assn.
Sept. 12.....Canfield, O., Track Meeting, Canfield Fair Assn.
Sept. 13.....Covington, Ky., Track Meeting, Cincinnati Automobile Club.
Sept. 13.....Grand Rapids, Mich., Track Races, Grand Rapids Automobile Club.
Sept. 20 21.....Detroit, Mich., Track Races, Michigan State Fair.
Sept. 27-28.....Bakersfield, Cal., Track Races, Kern Co. Fair Assn.
Nov. 4-5.....El Paso, Tex., Road Race to Phoenix, Ariz.
Nov. 4-5.....Los Angeles, Cal., Road Race to Phoenix, Ariz.
Nov. 4-5.....San Diego, Cal., Road Race to Phoenix, Ariz.
Nov. 6.....Phoenix, Ariz., Track Meeting, State Fair.
Nov. 24.....Savannah, Ga., Vanderbilt Cup Race, Motor Cups Holding Company.
Nov. 27.....Savannah, Ga., Grand Prize Race, Automobile Club of America.

Foreign

Sept. 21.....Boulogne, France, 3-Litre Race.
Sept. 25.....Isle of Man, International Stock Car Race.
October 17-28.....Paris, France, Automobile Show, Grand Palais, 10 days.
November 7-15.....London, Eng., Annual Automobile Exhibition, Olympia.

The Week in the Industry



Engineer — Dealer — Repairman — Garage

CHANGES IN INDIANAPOLIS—The opening of the 1914 season is seeing a number of changes in the Indianapolis, Ind., motor car trade. One of the most important announcements is that Frank E. Smith, former general manager of the Newcastle plant of the United States Motor Co., has become vice-president of the J. I. Handley Co. The Archey-Atkins Co. has gone out of business, Harry Archey taking the agency for the Alco, while the Hudson agency, formerly held by the Archey-Atkins Co., has been taken by B. M. Wylie, 428 North Capitol avenue. Donald G. Small, who was with the Archey-Atkins Co., has been appointed superintendent of service for the Hudson Motor Car Co. in Indiana, Michigan, Ohio and Kentucky, and will make his headquarters with Mr. Wylie. E. T. Klee has been appointed manager of the truck department of the Gibson Auto Co., which has taken on the Garford and Willys-Utility. W. H. Harbison has become distributor in Indiana for gasolette and will make his headquarters in this city.

KIRBY GENERAL SALES MANAGER—W. H. Kirby has become general sales manager for the Harmon M. C. Co., Seattle, Wash.

VINCENT CHICAGO REMY MANAGER—E. R. Vincent has been appointed manager of the Chicago, Ill., branch of the Remy Electric Co.

MOVES IN PROVIDENCE—W. L. Wilcox & Co. Franklin dealer in Providence, R. I., is now occupying new salesrooms at 320 Broad street.

BALTIMORE FRANKLIN MOVES—The Franklin M. C. Co., Baltimore, Md., has moved to North Eutaw street, between Preston and Biddle streets.

MADDOCK RESIGNS FROM RAMBLER—E. S. Maddock, assistant secretary of The Thomas B. Jeffery Co., Kenosha, Wis., has resigned his position.

STEARNS OPENS FACTORY BRANCH—The F. B. Stearns Co., Cleveland, O., has opened its new factory branch in Los Angeles at 742 South Olive street.

APPOINTED BOSCH AGENT—The George B. Wuestefeld Co., of New Haven, Conn., has been appointed Bosch agent and will handle that make of electrical fittings.

WARDLAW RESIGNS FROM FEPS—W. E. Wardlaw, manager of the New York branch of the Schoen-Jackson Co., manufacturer of the Feps carburetor, has tendered his resignation.

CONWELL HAYNES MANAGER—J. C. Conwell, of Los Angeles, Cal., has been appointed manager of the Southern California and Arizona field of the Haynes Auto Sales Co. of Calibornia.

RAMEY LOZIER SOUTHERN MANAGER—R. R. Ramey as been appointed sales manager of the Southern District for the Lozier Motor Co., Detroit, Mich. His headquarters will be at New Orleans, La.

TAKES CHARGE OF FORD BRANCH—Carl S. Walker has been appointed manager of the Ford branch at Newburyport, Mass., to succeed Sidney Ashe, who resigned to go into mercantile work.

PHILADELPHIA FIRM MOVES—The headquarters of the V. P. Padula Motor Co., Philadelphia, Pa., distributor of the Havers and the Abbott-Detroit cars, have been removed to 152 North Broad street.

MCFARLIN RESIGNS FROM JONES—F. H. McFarlin, who was general sales representative with the Jones Speedometer Co., New York City, has resigned to represent the Clysmic Spring Water Co., Waukesha, Wis., in New York City.

VULCANIZING PLANT OPENED—Under the name of the Western Rubber Company, J. J. Mahoney, E. Kadletz and Charles H. Brown have opened a complete vulcanizing and retreading plant in Phœnix. It is the first rubber plant in Arizona.

SEATTLE FRANKLIN DEALER MOVES—W. A. Wicks, Franklin dealer in Seattle, Wash., has moved into new quarters in a new fireproof concrete building at Twelfth avenue and East Union street. A complete repair shop adjoins the salesrooms.

REMODELING THE SALESROOMS—The salesrooms on Commonwealth avenue to be occupied by the Fosdick-Wentworth Company, agents for the Hupmobile in New England, are being remodeled so that there will be more space for the showing of cars.

IN TEMPORARY QUARTERS—Chas. E. Riess & Co., distributors of the Hupmobile, are occupying temporary salesrooms at 1692 Broadway, New York City, and announce that they expect to open their permanent quarters at 1690 Broadway in about 2 weeks.

MANCHESTER PURCHASES APPARATUS—The town of Manchester, Conn., has voted $8,000 for the purchase of motor fire apparatus. This, to a degree, is to enable the town to participate in the mutual aid proposition advanced by Horace B. Clark, president of the Hartford board of fire commissioners.

USING OLD CAR AS A PLOW—John Dance, a farmer north of Findlay, O., is using his Pope-Toledo attached to a plow to do all his fall plowing. He says he has never seen such a success in plowing, and predicts that within a few years every farmer in the country will be using his car for the same purpose.

MOTORIZES FIRE DEPARTMENT—The Des Moines, Ia., city council recently started to motorize the fire department of the city by placing an order for $72,000 worth of mortor-driven apparatus with the American-La France Co. Twelve trucks are in the first order and later the entire department will be rid of horses.

NEW MANAGER ELECTED—Ellis Y. Eldredge, who has been assistant cashier of the Second National Bank at Bangor, Me., has been elected manager of the Bangor Motor Co., succeeding Byron W. Austin, who has gone to Detroit, Mich., to accept a position. He will resign from the bank shortly to accept the new position.

$500,000 BUILDING FOR PHILADELPHIA—A $500,000 building will be erected in Philadelphia, Pa., for the Ford M. C. Co. at Broad street and Lehigh avenue. The plans call for a 10-story concrete, brick and terra cotta structure, 312 by 376 feet, with frontages on Broad street. The building will contain more than 400,000 square feet of floor space.

TROLLEYS SPEEDING TOO—City authorities in New Britain, Conn., are anxious that the speed provisions of the State law be obeyed in that city. Of late attention has been directed to trolley cars, which, in the opinion of the city fathers, are traveling too fast. A resolution has been introduced in the common council with the idea of reducing the speed of the common carriers.

PENNSYLVANIA TAGS BLACK AND WHITE—Pennsylvania automobile license tags for 1914 will be black with white letters, instead of olive with white letters, as at present, and there will be five classes of license plates issued next year and hereafter under the automobile license act of July 7, 1913. The bids for the licenses were opened by the state highway commissioner on September 2.

MINNEAPOLIS' TRUCK RENTAL SERVICE—The Used Motor Truck Co., 220 Third street S., Minneapolis, Minn., will have a truck rental service as well as a sales department. This is the first company to begin the business of selling used motor trucks in this territory. The rental department will give merchants service in rush periods. W. H. Sill is head of the company and O. G. Scheig of the sales department.

AUSTIN STUDEBAKER SUPERINTENDENT—W. W. Austin has been made superintendent of the Studebaker Corp., Plant 15. This is the plant formerly known as the Vulcan Gear Works, and later part of the Flanders group at Pontiac, Mich., which has been taken by the Studebaker company for the purpose of maintaining a complete and separate service factory where replacement parts will be manufactured for all previous Studebaker models.

SALVAGE CORPS FOR INDIANAPOLIS—A salvage corps will be established immediately in Indianapolis, Ind., by the Indianapolis Salvage Corps which has been granted a charter by the state under the voluntary association act. The corps will be maintained by fire insurance interests in quarters to be furnished by the city. A motor truck will be bought and used for answering fire alarms. The insurance companies will meet the expenses of the corps by an assessment of one per cent on the annual gross premiums collected in Indianapolis and have set aside $12,000 for its equipment.

TO HAVE $2,000 GATE HOUSE—A novel building task was recently revealed by a plan filed with the Department of Buildings for a gate house, which is to take the place of a five-story tenement house, at 25 West 60th street, N. Y. City. The plans call for a one-story fireproof building, 18 by 40.4 feet in area, which is to serve as an entrance to driveway for the large eleven-story garage recently completed by the same architect, 16 to 24 West 61st street. This gate house will cost $2,000, and will be built for A. R. E. Pinchot, who has the garage construction under a 21-year lease arrangement for the Locomobile Co. of America.

FINDLAY AUTOISTS AGAINST TAX—Findlay, O., automobilists generally are protesting against the new automobile law, which imposes a tax of from $5 to $18 for a car, according to the horsepower of the machine. The present tax is $3 for electric cars and $5 for gasoline cars. The tax was imposed under the guise of a police regulation, and so long as the income, amounting to about $600,000 per year, was devoted to the building of roads, the motorists made no objection. But under the new law the tax will be twice as great and only one-third will be given to road work, the remainder going to help pay the general expenses of the state. To resist the double taxation, the Lima Automobile Club has been organized with forty-three members. The organization will join the state body in testing the new law.

PENCE BUILDS LARGE WAREHOUSE—H. E. Pence, president of the Pence Automobile Co., Minneapolis, Minn., is to build an automobile storage warehouse which he expects to be the largest in America. He will build it under the name of Equitable Automobile Warehouse Co. The contract was let recently for $50,000, the warehouse to be completed November 1. The building will be 222 feet front on Washington avenue and on Great Northern and Burlington trackage and 150 feet deep on Eighth avenue. The building will be two stories, of mill and concrete construction. It will hold 2,000 automobiles through a double deck arrangement, by which each floor will accommodate two tiers of motor cars. The Pence company will use part of the storage and will rent the remainder. Mr. Pence said there is no good place for automobile storage for general use and he will supply the want. The loading track will carry five freight cars at one time.

PATHFINDER'S NEW SELLING PLANS—The Motor Car Mfg. Co., Indianapolis, Ind., is laying the groundwork for a larger and more efficient selling organization in its eastern territory, which will be worked directly from the factory hereafter instead of through a selling agency, with headquarters at Philadelphia, as during the last two years. Coincident with this announcement comes the appointment of F. G. Ricker, formerly of the Simms Magneto Co., to the Pathfinder sales force. Mr. Ricker will have headquarters at the Pathfinder Motor Car Co. show rooms, 1700 Broadway, New York City. At the present time the live Pathfinder teeritory is being covered by district sales managers, appointed by general sales manager, L. E. Willson, as follows: B. F. Jacobs, Pacific Coast and Rocky Mountain region; I. C. Anderson, Texas and Southern states; Chas. H. Eichinger, Middle West and Northwest. The foreign business will be under the direction of Claude M. Nankivel, 17 State street, New York City, as in the past.

TO BUILD BOSCH CASINO—Plans have been filed for and work started by the Bosch Magneto Co. on a casino building to cost $18,000 in North Main street, Springfield, Mass., opposite its factory. The building, which has been contemplated for some time, will be a rest and recreation structure for the employees of the company. It will face on North Main street, and the dimensions are 84 by 107 feet. Some of the features of the building are: A big dining hall, just off the main entrance, where the employees of the factory will be able to get meals at a nominal price. The size of this room will be about 60 by 60 feet. On the right of the entrance will be a rest and game room, and on the other side of the entrance will be the kitchen and serving room connected with the dining hall. The basement will be fitted with bowling alleys. Broad piazzas will run on the north and south sides of the building, and these will be supported by pillars. The roof of the building will be supported by wooden trusses, and these will be exposed and a part of the finish of the building.

Recent Incorporations in the Automobile Field

AUTOMOBILES AND PARTS

BRIDGEPORT, CONN.—Bridgeport Body Co.; capital, $50,000; business will be confined to motor car bodies.

BRIDGEPORT, CONN.—Manufacturers' Sales Agency; capital, $25,000; to deal in automobiles and accessories. Incorporators: Miles V. Doud, Frederick K. Doud, William L. Scott.

BROOKLYN, N. Y.—Flatbush Ave. Taxicab Co.; capital, $5,000. Incorporators: Chas. Stork, John Wilmartin, William H. Fangemann.

CAIRO, ILL.—Angler Automobile Service Co.; capital, $200; automobile taxicab service. Incorporators: W. E. Angler, Mrs. P. M. Angler, D. C. Morrison.

CAMDEN, N. J.—Row Truck Sales Service Co.; capital stock, $100,000; to manufacture, sell and deal in automobiles and motor trucks. Incorporators: Chas. P. Steelman, Harry W. Severns, J. C. Hoffman.

CHICAGO, ILL.—Gren Motor Car Co.; capital, $25,000; to manufacture motors and automobiles. Incorporators: G. H. Wilkins, R. C. Steels, T. S. McCoy.

CHICAGO, ILL.—Mogul Starter Co.; capital, $75,000; to deal in machinery. Incorporators: J. T. Buchanan, R. C. Nicholson, C. W. Paltzer.

CINCINNATI, O.—Eureka Automobile Co.; capital, $10,000. Incorporators: G. W. Ammerman, J. M. Decamp, R. M. Ochiltree.

CLEVELAND, O.—Euclid-Superior Auto & Supply Co.; capital, $10,000; to deal in automobiles and supplies. Incorporators: C. R. Williamson, E. M. Bell, W. R. Winn, P. A. Knoedler, D. J. Lombard.

CLEVELAND, O.—Falcon Company of Cleveland; capital, $15,000; to deal in automobiles and automobile accessories. Incorporators: Jas. H. Cassidy, D. C. Meek, Mark A. Copeland, C. Vorbsky, W. S. Mitchell.

COLUMBUS, O.—J. P. Gordon Co.; capital, $500,000; to manufacture automobile accessories, waterproof shields. Incorporators: J. P. Gordon, Irvin Pirsig, Frederick C. Brock, Arthur Reinhard, Alois Hegelheimer.

DANVILLE, ILL.—Danville Motordrome Co.; capital, $1,000. Incorporators: J. R. Todd, Chas. A. Sparks, C. M. Cook.

DETROIT, MICH.—American Cyclecar Co.; capital, $500,000; to manufacture cyclecars. Incorporators: A. H. Trumbull, Harry J. Stoops, I. B. Trumbull.

DETROIT, MICH.—Vanguard Mfg. Co.; capital, $10,000; to manufacture automobile engines, machinery and equipment. Incorporator: Chas. R. Jensen.

DETROIT, MICH.—Princess Cyclecar Co.; capital, $200,000; to manufacture automobiles and hydroplanes. Incorporators: Isaac N. White, Herbert H. Dawson.

INDIANAPOLIS, IND.—Herff-Brooks Corp.; capital, $100,000; to control the sale of Marathon cars. Incorporators: George Herff, Herbert Herff, Jacob Herff.

KANSAS CITY, MO.—Thorp-Allen Motor Co.; capital, $10,000. Incorporators: William R. Thorp, H. B. Thorp, H. L. Allen.

LOUISVILLE, KY.—Chawk-Smith Automobile Co.; capital, $4,500. Incorporators: John T. Chawk, William J. Chawk, Harry R. Smith.

LYNBROOK, N. Y.—Metropol Motors Corp.; capital, $50,000. Incorporators: Robert D. McKay, J. F. Wiggin, F. W. Preuss.

OKLAHOMA CITY, OKLA.—Hupmobile Sales Co.; capital, $5,000. Incorporators: W. H. Say, L. S. Liggett, Harry Pole.

PITTSBURG, PA.—Bartley Auto Nut & Bolt Fastener Co.; capital, $5,000. Incorporators: Milton Bartley, H. D. Johnson, A. T. Clark.

ROCHESTER, N. Y.—Rochester Motors Co.; capital, $300,000; automobiles. Incorporators: Geo. F. Davison, E. A. Grenelle, Albert H. Stearns.

SPOKANE, WASH.—Spokane Automobile Mfg. Co.; capital, $50,000; to deal in motor cars. Incorporators: R. L. Dickerson, E. A. Torrance.

SPRINGFIELD, MASS.—Martin Tractor Co.; capital, $350,000; to develop the tractor and sublet manufacturing rights to outside concerns. Incorporators: Harry G. Fisk, C. H. Martin, Ed. O. Sutton, Chas. H. Beckwith.

ST. LOUIS, MO.—Anselm-Genahl Motor Car Co.; capital, $5,000; to buy and sell automobiles, automobile parts, accessories, etc.

TOLEDO, O.—Dewey-Anderson Mfg. Co.; capital, $50,000; to do a general manufacturing business including the making of all motor-driven vehicles. Incorporators: Rodney C. Dewey, Herbert A. Anderson, Richard D. Logan, Stanley Roberts, G. D. Heitzler.

TROY, N. Y.—Scott D. Nichols, Inc.; capital, $10,000; to do a general automobile business. Incorporators: Scott D. Nichols, Marion Nichols, Anna MacNeil.

UTICA, N. Y.—Wahl Auto Sales Co.; capital, $2,000. Incorporators: M. F. Robischon, E. R. Robischon, J. J. Lanz.

WALKERVILLE, ONT.—Fisher Motor Co.; capital, $150,000; to manufacture automobiles, machinery, etc. Incorporators: C. F. Garaghty, F. E. Fisher, F. W. Vollans.

WASHINGTON, D. C.—Probey-Haynes Motor Car Co.; capital, $10,000; to handle the Haynes Car. Incorporators: T. Oliver Probey, I. Harry Stuart, W. D. Arrison, J. E. Welch, M. M. Probey.

WILMINGTON, DEL.—Kearns Motor Truck Co.; capital, $10,000; to manufacture, sell and deal in motor trucks and vehicles of all kinds. Incorporators: Geo. G. Steigler, M. E. Grubb, W. M. Pyle.

WILMINGTON, DEL.—Merchants Motor Express Co.; capital, $75,000. Incorporator, Harry W. Davis.

WILMINGTON, DEL.—Auto Tire Sales Co.; capital, $100,000. Incorporator: B. M. Grawl.

GARAGES AND ACCESSORIES

APPLETON, WIS.—Sunshine Oil Co.; capital, $5,000; to deal in petroleum and petroleum products, lubricants, etc. Incorportors: B. J. Zuehlke, W. W. De Long, W. Fisch.

BROOKLYN, N. Y.—Ohlsson Spring Tire Co.; capital, $30,000; to manufacture and deal in motor accessories. Incorporators: C. J. Ohlsson, J. Maddocks, P. J. Butterly.

BUFFALO, N. Y.—Clifford Co., Inc.; capital, $15,000; to deal in equipment for auto boats, etc. Incorporators: William M. Sellec, Clarence C. Clifford, Welford Golden.

CHICAGO, ILL.—Nemo Chemical & Specialty Mfg. Co.; capital, $25,000; to deal in and manufacture oils, rubber products, accessories, etc. Incorporators: Henry A. Gano, John T. Whitehead, Conrad E. Niehoff.

CHICAGO, ILL.—William Knobloch Co.; capital, $20,000; to maintain and replace parts of electric vehicles and appliances. Incorporators: William Knobloch, Karola Knobloch, Van Lear E. Farmer.

FARMINGTON, MO.—St. Francois Motor Co.; capital, $14,000; to equip a repair plant and garage. Incorporators: M. L. Clardy, Jr., R. P. Land, C. E. Rozier.

GLENCOE, ILL.—Glencoe Garage & Livery Co.; capital, $5,000. Incorporators: Thomas M. Whitson, Isaac S. Brill, Isaac B. Lipson.

MILWAUKEE, WIS.—Goodyear Rubber Co.; capital, $25,000; to manufacture tires. Incorporator: J. H. Suydan.

NEWARK, N. J.—C. F. Briggs Co.; capital, $35,000; general automobile garage and salesroom. Incorporators: C. F. Briggs, A. J. Mousley, A. H. Townsend.

NEW YORK CITY—Oleo Shock Absorber Co. of America; capital, $30,000. Incorporators: John F. Booth, August Estelmann, Harry A. Bell.

NEW YORK CITY.—Jesco Equipment Co.; capital, $12,000; to deal in auto accessories. Incorporators: Frank D. Boulanger, Alfred Ware, Geo. W. Wacker.

NORWALK, CONN.—Cole-Briscoe Mfg. Co.; capital, $10,000; to manufacture parts and specialties.

NORWALK, CONN.—Todd Rubber Co.; capital, $2,000; to deal in tires and rubber goods. Incorporator: Eyler J. Todd.

PINE BLUFF, ARK.—Mann Motor Car Co.; capital, $10,000; to do a general automobile and taxicab business. Incorporators: J. H. Mann, Jr., J. H. Mann, Sr., W. D. Mann.

CHANGE OF NAME AND CAPITAL

CLEVELAND, O.—Velie-Paige Motor Car Co.; change of name to Velie Motor Car Co.

DETROIT, MICH.—Grant Motor Car Co.; capital increased from $165,000 to $200,000.

ST. JOSEPH, O.—Holliday Motor Car Co.; capital increased from $10,000 to $15,000.

New Agencies Established During the Week

PASSENGER VEHICLES

Place	Car	Agent
Atlanta, Tex.	Krit	Oden-Ellington & Co.
Augusta, Ga.	Haynes	Augusta Machine Co.
Baltimore, Md.	Haynes	Haynes Motor Sales Co.
Birmingham, Ala.	Haynes	Chas. W. Tway.
Boston, Mass.	Haynes	W. L. Russell Co.
Boston, Mass.	Ohio	D. C. Tiffany
Boston, Mass.	Westcott	Fred A. Loud Co.
Bowling Green, O.	Overland	Bowling Green Garage
Burlington, Vt.	Chandler	Clifton C. Daigle
Canton, O.	Chandler	Standard Motor Car Co.
Champaign, Ill.	Buick	Champaign-Buick Motor Co.
Champaign, Ill.	Chalmers	Champaign-Buick Motor Co.
Charlotte, N. C.	Haynes	Auto Sales Co. Inc.
Chicago, Ill.	Dorris	Dorris-Crawford Co.
Chicago, Ill.	Garford	National Motor Car Co.
Chicago, Ill.	Haynes	Haynes Motor Car Co.
Cincinnati, O.	Haynes	Heilman Motor Car Co.
Columbus, O.	Paige Detroit	Central Auto Vehicle Co.
Crestline, O.	Hudson	Krogeal & Paisel
Cumberland, Md.	Haynes	Queen City Garage
Davenport, Ia.	Premier	Means Auto Co.
Decatur, Ill.	Haynes	James G. Parker
Decorah, Iowa	Haynes	R. B. Bergeson
Des Moines, Ia.	Jackson	Capital City Carriage Co.
Des Moines, Ia.	King	Holsman Sales Co.
Des Moines, Ia.	Partin Palmer	Partin-Palmer-Iowa Co.
Englewood, N. J.	Haynes	Stillman & Hoag
Farmington, Mo.	Henderson	St. Francois Motor Car Co.
Greenwood, Miss.	Haynes	Kimbrough Auto Co.
Hilliards, O.	Hudson	Leroy Dobbins
Houston, Tex.	Chandler	James C. Clinton
Houston, Tex.	Haynes	Jas. J. Gorman
Indiana, Pa.	Chandler	Clymer Motor Car Co.
Indianapolis, Ind.	Maxwell	Bradley & Martz
Jackson, Miss.	Haynes	Floyd Willis
Jacksonville, Fla.	Haynes	Thomas-Williamson Co.
Joliet, Ill.	Haynes	Joliet Motor Car Co.
Kansas City, Mo.	Haynes	Haynes Motor Car Co.
Kempton, Ind.	Haynes	Goodnight & Connaree
Kenneth, Ind.	Haynes	Kenneth Automobile Co.
Kokomo, Ind.	Haynes	Seaward & Son
Lima, O.	Chandler	B. A. Bleck
Logan, O.	Hupmobile	Theodore Johnson
Logan, O.	Paige Detroit	Theodore Johnson
Logan, Utah	Chandler	G. F. Thatcher
London, Ont.	Haynes	R. Hueston & Son
Los Angeles, Cal.	Maxwell	Lord Motor Co.
Lynn, Mass.	Chandler	Ernest Whitten
Macon, Ga.	Haynes	Geo. R. Napier
Manchester, N. H.	Chandler	Howard E. Johnson
Marietta, O.	Haynes	Marietta Motor Car Co.
Marion, O.	Hudson	C. C. Stoltz
Memphis, Tenn.	Haynes	Evander Williams & Co.
Minneapolis, Minn.	American	A. F. Chase & Co.
Minneapolis, Minn.	Chandler	Northwestern Automobile Co.
Minneapolis, Minn.	Imperial	M. H. Davis
Minneapolis, Minn.	Metz	Fawkes Auto Co.
Mobile, Ala.	Haynes	Edward L. Moran
Moline, Ill.	Chandler	J. H. Bushong
Montreal, Quebec, Can.	Oakland	Newmaster Tire Co.
Morristown, N. J.	Chandler	Wm. Stevenson Garage Co.
Nashville, Tenn.	Haynes	Stilz & Graessle
Newark, Del.	Haynes	Newark Garage
New York City	Haynes	Haynes Automobile Co.
Norfolk, Va.	Chandler	H. H. Johnson
Norfolk, Va.	Haynes	C. L. Young
Onawa, Ia.	Buick	Monona Auto Co.
Palmura, Mo.	Studebaker	Cad Bishop
Peoria, Ill.	Norwalk	Wheeler & Wood
Philadelphia, Pa.	Haynes	Johnson Motor Car Co.
Pittsburg, Pa.	Haynes	Pittsburg-Haynes Automobile Co.
Postville, Ia.	Chandler	O. J. Blessin & Co.
Roanoke, Va.	Haynes	Hunter Motor Co.
Rochester, N. Y.	Chalmers	J. J. Mandery
Rochester, N. Y.	Haynes	A. M. Zimbrich
Rockford, Ill.	Haynes	Joslyn Automobile Co.
Rome, Ga.	Haynes	Cherokee Gar. & Machine Co.
San Francisco, Cal.	Haynes	Haynes Auto Sales Co.
Scranton, Pa.	Haynes	Peter Boyrent
South Bend, Ind.	Haynes	Carson & Smith
St. Louis, Mo.	Westcott	Paine Auto Co.
Table Grove, Ill.	Haynes	Harry Foster & Son
Toledo, O.	Meteor	Cornelius-Hohly Auto Co.
Utica, N. Y.	Chandler	Skinner Motor Car Co.
Vermillion, S. D.	Haynes	M. L. Thompson
Washington, D. C.	Apperon	Emerson & Orme
Weatherford, Tex.	Krit	Clarence Hopkins
West Union, Ia.	Chandler	Booth & Probert
Winchester, Ill.	Moon	I. C. Hill
Windsor, Ont.	Unomobile	L. W. Fraser
Worcester, Mass.	Haynes	J. C. Harvey

COMMERCIAL VEHICLES

Chicago, Ill.	Selden	Dorris-Crawford Co.
Chicago, Ill.	Star	Austin Doyle's Sons.

KEMCO Fan Generator—The problem of fitting a generator on a used car is offered another solution in the Kemco fan type generator shown in Fig. 1. The simplicity of the device is evident from the illustration. In consists of a compact cylindrical generator mounted on the radiator fan bracket and forming virtually a new hub for the fan. Nothing special is necessary in fitting. The drive is by the same belt as used for the fan only, and it is claimed that there is an inappreciable amount of extra power required with the generator applied. The fan blade area displaced by the generator casing represents practically no loss of efficiency as far as the fan draught is concerned, as it is well known that the inner end of a fan blade is of very little use.

Constructionally the machine differs from standard generator practice in that the field remains fixed in the center while the armature revolves around it. Among the advantages obtained by this construction are the better cooling and the more certain retention of the windings, the latter effect because centrifugal force is tending to force the winding in and not out of the slots. The brushes are of the round carbon type and the maker claims that the machine is capable of running 50,000 miles without a change in the brushes.

As regards the charging characteristics, the generator starts charging the battery at 400 revolutions per minute and reaches the maximum at 1,200 revolutions. Further charging and regulation of the machine is automatically accomplished by magnetic leakage gaps incorporated in the construction of the machine.

The machine is water, dust and oil proof. It is mounted eccentrically on the shaft in the customary manner of fans to provide for belt adjustment. An ammeter is furnished as part of the equipment and this is mounted on the dash. A peculiar advantage arising out of the method of driving fan and generator at the same time is that this ammeter furnishes a ready indication as to the operation of the belt. A slipping belt and the consequent imperfect cooling action of the fan on the radiator is shown immediately by the needle of the ammeter.

A cut-out is incorporated in the same base as this ammeter and to this the main wire issuing from the generator is connected. The other unit in the wiring system is the combined switch and distributer board of cruciform shape shown in the diagram, Fig 2. All lamp leads issue from terminals on this distributer board direct so that there are no outer connections to cause trouble.

The manufacturer is the Kemco Electric & Mfg. Co., Cleveland, O.

Green's Top Lifter—The Simplex Specialties Co. has been established at 730 Woodward avenue, Detroit, Mich., for placing upon the market Green's top lifter. The new device is made up of two brass tubes, one collapsing into the other, into the ends of which are fastened crooked shaped castings. Sliding over the tubes is a rider, in which is a hole for receiving the iron at the bottom of the front bows, as shown in the photograph. The telescoping feature allows the device to be carried in the tool compartment of the car. When it is desired to raise the top the bow iron is slipped out of the hole in the rear top bracket and one end of the lifter is put into its place and the other end is slipped into the hole in the forward bracket. The bow iron is put into the rider. The operator next goes to the other side of the car, pulls the top up by the strap and carries the front bows on that side to the front bracket and fastens the iron in the usual way. In the meantime the bows on the other side have been moving forward with the slide, as shown in Fig. 3. The front straps are snapped in place, without the usual tugging, before the lifter is taken out. Then the lifter is removed and the bows are fastened in place. The curved ends of the lifter are so shaped that the rod is easily put on and taken off the car, and yet is held firmly in place while it is in use. The complete outfit is nickel plated. This accessory is light and takes up very little room. It makes a "one-man top" on any American car, which can be raised easier than the English pantograph tops that go by that name.

The Recordograf—An instrument which will prove of vast interest to operators of trucks and delivery wagons has been put on the market by the Delivery Supervision Co., Inc., 735 Seventh avenue, New York City. This little instrument, shown in Fig. 4, called the recordograf, acts as an automatic detective when attached to any wheeled vehicle. Every minute of the vehicle's time is accounted for on the paper tape record kept by this device. It records the time of the start; the time of return; the distance covered during the day; the time each stop was made during the day; the time each stop was made and its duration; the various speeds made during

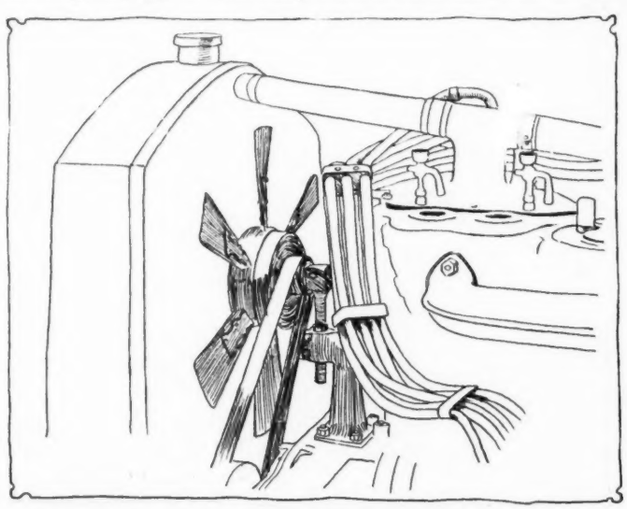


Fig. 1—Kemco fan generator as it appears installed on a car

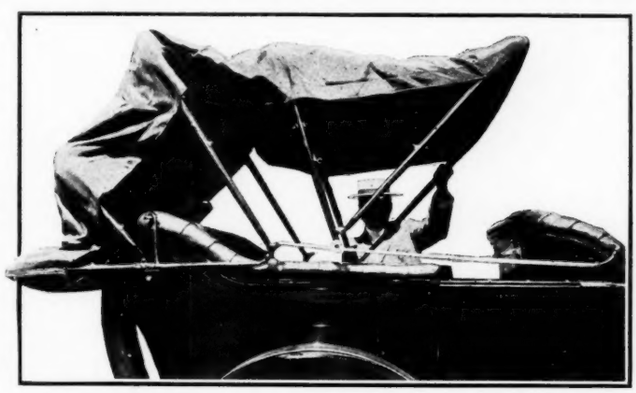


Fig. 3—Green's top lifter for one-man operation

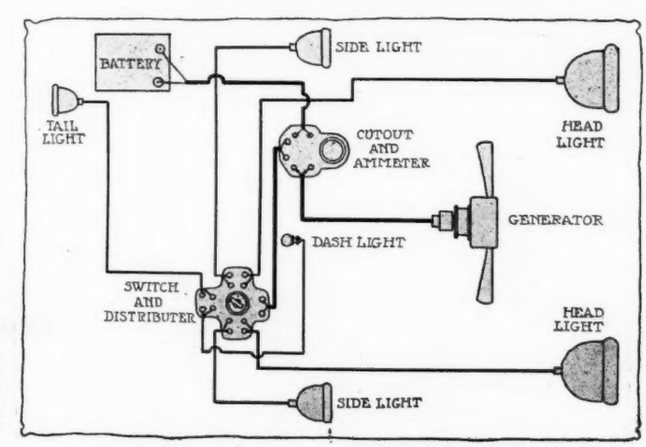


Fig. 2—Wiring diagram of the Kemco fan generator

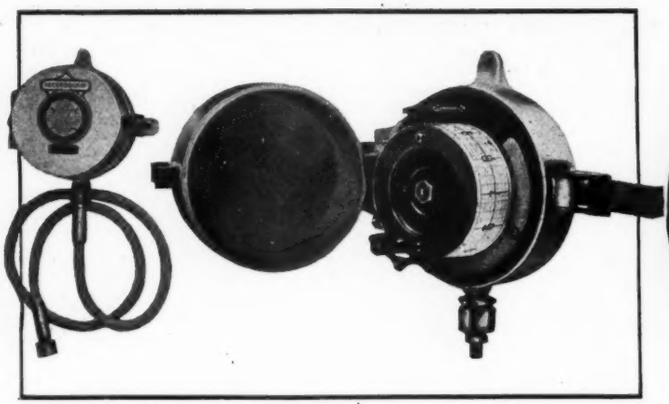


Fig. 4—The Recordograf as it appears open and closed, showing the central drum, which carries the paper record

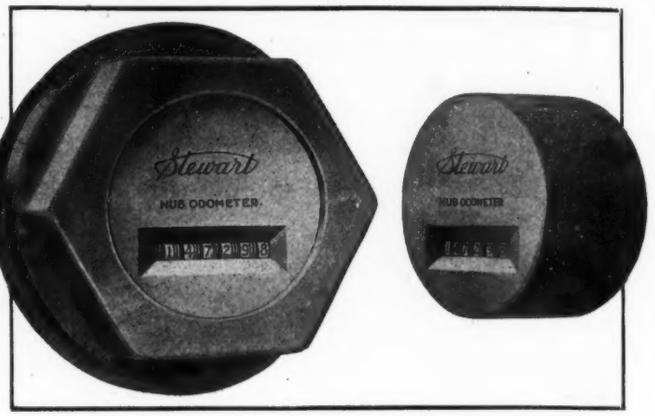


Fig 6—Two types of the Stewart hub odometer for electrics

the day and the speed with which the vehicle was moving at any particular moment. With all this information regarding every vehicle at hand, it is easy to see that operators of large fleets of vehicles, especially of a package delivery, such as department stores, etc., were immediately put in closer touch with their delivery department and the inefficiency, waste and leaks pointed out.

The instrument was invented by E. A. Henkle, a Philadelphia man. A paper tape about twice the width of regular ticker tape is ruled with vertical lines, the spaces between which represent 15 minutes of time, spaces between horizontal lines represent quarter miles. A most ingenious clockwork arrangement moves a pointer over the tape. When the vehicle is standing still the clock moves the pointer in a straight horizontal line. When in motion, the connection by flexible shaft, working in conjunction with the clockwork, moves the pointer up and down and along the tape according to the speed. By tracing the line made by the pointer over the horizontal and vertical rulings, the entire record of the day of the vehicle is made plain.

Two sections of the tape from a day's record on a horse-drawn vehicle and a motor truck respectively, shown in Fig. 5, afford an interesting comparison. The arrows denote various speeds calculated and stamped on by the company's experts.

Experts from the Delivery Supervision Co. change the tapes or records daily. The tapes are then gone over carefully, speed, mileage, etc., computed by trained men and a complete report made to the owner. No possibility exists of interception by an employe, as the instrument is locked with a specially designed lock during the day. The company leases its instruments to its clients at a cost varying with the number of installations, and assumes supervision of the delivery system, as its name implies. In territory not reached by any of the company's branches the instrument is sold outright.

Stewart Hub Odometer—Fig. 6 shows the Stewart hub odometer, made by the Stewart & Clark Mfg. Co., Chicago, Ill. This instrument is fitted in the hub cap of an electric car. It is operated by a positive drive. This drive consists, not of thin metal discs, but of steel pinions with worm and spiral gears, each pinion being machined from a single piece of steel, heat treated and hardened, to resist wear. With this positive drive, it is claimed, there can be no failure of the odometer to record. Through an ingenious application of the Geneva stop mechanism the dials are locked, excepting at the instant of registering. Those not registering remain locked. Thus it is impossible for the dials to fail to register. This odometer is springless; there are no pawls or ratchets. This company manufactures another hub odometer, with the same mechanical features, having a 100,000-mile season register. The numbers are black on white. It also shows tenths of a mile red figures.

Woodward Impulse Tire Pump—Woodward & Son, Toledo, O., are the manufacturers and distributors of the Woodward impulse tire pump. This device, Fig. 7, consists of a single cast iron chamber divided into two sections of different diameters, the larger of which in operation is connected directly through a 12-foot length of flexible hose to the tire for inflation purposes. Inside a double diameter reciprocating piston is the means of transferring the pressure of the air inside the cylinder to that which is delivered to the tire. There is no actual connection other than the piston between the two chambers of the pump cylinder, so that only fresh air passes into the tire. There is a gauge connected to the hose. The self-opening valve is a great convenience in attaching the hose. It has insulated handles which enables it to be detached without burning the fingers or using a wrench. The hose is of woven silk cloth on the outside and rubber inside. The pump is regularly equipped with a .5-inch standard pipe thread. When either A.L.A.M. standard thread or metric thread pump connectors are required they will be furnished on application. It uses neither oil nor hard grease, so there is not the slightest danger of injury to the tires.

Virginia Waterproofing Compound—The Virginia Waterproofing Corp., Norfolk, Va., makes the Coleman waterproof filler. This compound is a colorless fluid, which is applied with a brush, and drys quickly. It is not a coating, but a filler. This is used in waterproofing the outer layer of a top, either canvass or cloth, protecting it from rotting or splitting.

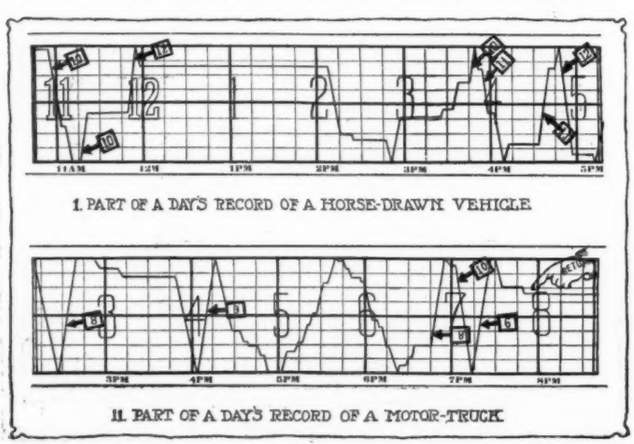


Fig. 5—Two sections of Recordograf tape. Arrows indicate speeds

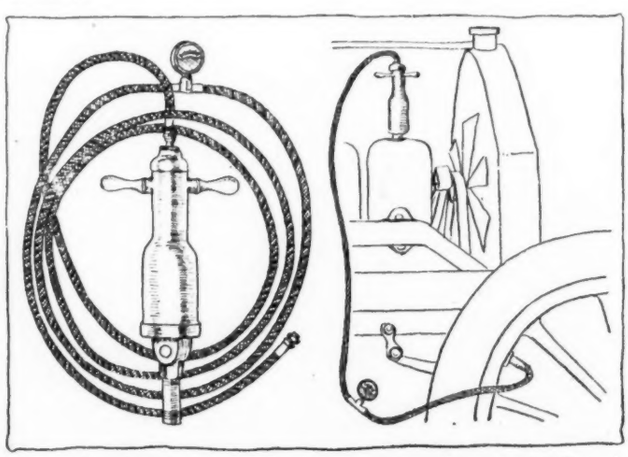


Fig. 7—Woodward impulse tire pump and method of attachment